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## Contents

Page

Editorials:
The Treatment of Low Grade Ore 243
American Institute of Mining Engineers ..... 244
The Steel Trust Investigation.... 244
Wages at Butte..... 244
Correspondence and Discussion:
Caving System of Mining in America....Colorimetric Copper Assay 245
Geology Applied to Mine Examination.....Ira B. Joralemon 247
Volumetric Method for Thorium.... 249
Antimony a Byproduct Only..... 249
Operations at Goldfield Consolidated for June, 1912..... 250
July Mining Dividends..... 250
Chronology of Mining for July, 1912 250
U. S. Borax Production..... 251
Lime in Cyanidation...C. E. Rhodes 251
Rhodesia Mining Notes..... 252
Midwest Oil Co., Casper, Wyo..... 252
Details of Practical Mining:
*An Arc Light Tower....City Deep Winding Engine....*A Bucket Dump-Hook.... Headframe with Guy Rope Bracing....*Joplin Ore Bucket....*Concrete Collars for Mine Shafts ..... 253
Details of Metallurgical Practice:
*Repairing a Gyratory Crusher....
*The Diaphragm Cone Classifier .... Keeping the Commutator Clean ..... 257
Notes from Current Literature:
Gold Absorption by Retorts.... Shipping Cement in Bulk....Pig Steel by Direct Smelting....Potash from Insoluble Silicates.... Elemental Character of Tellurium ....Value of Sanitation....Salt Industry Byproducts....Solubility of Gold In Nitric Acid....Separation of Zinc and Iron....Cottrell Fume Precipitation....Regulation of Engineering Practice in Austria.... Power Direct from Blast Furnace Gas .... Spontaneous Combustion of Charcoal ..... 259
*The Union Dredge at Folsom, Calif.....Lewis H. Eddy 261
U. S. Barytes Production..... 263
*The Parks Electrocyanide Process 263
Advantages of a Level Stope.
H. Y. Russel 265
U. S. Production of Magnesite..... 266
*Mining Copper at Lake Superior —IV.....Claude T. Rice 267
Tin Production of Seward Peninsula 270
Thornthwaite Mine, England..... 270
*Bolivian Tin Mining.
Mark R. Lamb 271
Personal, Obituary and Societies.... 274
Editorial Correspondence ..... 275
Mining News ..... 277
Markets ..... 283
*Illustrated.

# The Engineering and Mining Journal

Vol. 94. AUGUST 10, 1912 No. 6

## The Treatment of Low Grade Ores

The American Mining Congress through its officers is persistent in its beseeching of Congress to make appropriations to assist the mining industry. Investigations by Federal scientists to discover more profitable methods for the treatment of low-grade ores is the theme that is harped upon constantly. In a recent statement prepared by Mr. Callbreath for the members of Congress, the following remarks are made:

"For some years past the metalliferous mining industry of the West has not kept pace with the development of other lines of enterprise. With rare exceptions the population of all the mining camps in the West decreased during the period 1901-10 and in many instances low-grade mining camps have been entirely abandoned.

"A solution of the problem of economical treatment of low-grade ores is the one method through which this great fundamental industry can be revived. This problem is too great for private enterprise and whenever improvements are made by private effort the results are kept secret and do not serve the general good. The West has a right to expect Federal aid in the solution of these problems."

More misleading ideas are concentrated in these unsupported allegations than it is often given to any individual to compass.

Is it true that the metalliferous mining industry of the West has failed to keep pace with other industries? If so, wherefore the huge increases in the production of copper, lead and spelter?

If it be true that the population of all the mining camps in the West, with rare exceptions, decreased during the period, may it not be that improvements in the arts of mining and metallurgy enabled an increased tonnage of ore to be worked with fewer men? If so, is not that an economic advantage?

If many low-grade camps have been abandoned, may not that be because their mines have been exhausted?

Mr. Callbreath says that the problem of low-grade ores "is too great for private enterprise and whenever improvements are made by private effort the results are kept secret and do not serve the general good."

Let us consider the progress in the art during the last 25 years. Excluding the advances that have been purely mechanical developments, such as the art of gold dredging, the improvement of crushing machinery, the increases in the dimensions of furnaces and the like; excluding, moreover, the progress in special arts, such as the manufacture of aluminum and the extraction of brimstone from rock in place; shutting our eyes to the marvellous progress in the art of mining, and confining our view to ore dressing and metal extraction alone, we are inclined to summarize the major developments in the art, those that have introduced new principles and have been of far reaching effect, as follows:

Electrolytic Copper Refining.
The Cyanide Process.
Pyritic Smelting.
The Wilfley Table.
Magnetic Separation.
Blast Roasting.
Sliming and Cyaniding.
Concentration by Flotation.
Bag Filtration of Smelting Fume.
Basic Copper Converting.

In some of these methods the inventors have enjoyed a moderate royalty, but in no case has there been the creation of any great fortune, although the inventions have been of the first order in metallurgical importance. In most cases, however, the actual introduction of the method has been the result of the crystallization of the ideas of many persons long previously expressed and no generic patent has been possible.

Who will have the temerity to aver that these problems have been too great for private enterprise, and if not them what problems are! Let the doubters read the life of Sidney Gilchrist Thomas and re-

flect on the way he tried the basic bessemer process.

We should like to be informed if the details of any of the great metallurgical steps that we have enumerated have been kept secret and if their results have failed to serve the public good. In fact they have, each and all of them, contributed to the exploitation of low-grade ores.

## American Institute of Mining Engineers

Measures for the adjustment of the affairs of the American Institute of Mining Engineers are gradually being formulated. The latest is the issuance to the members of the Institute by Dr. Douglas of an appeal for subscriptions to liquidate the indebtedness on account of the land fund. Dr. Douglas has made this appeal as a purely personal matter, no committee or group of members being involved in it.

The original obligation was $180,000. So far $112,000 has been promised and $106,000 collected. This has come through 91 subscriptions, $61,667 having been obtained through five subscriptions of $10,000 and over. Members and friends of the Institute who are residents of New York and Pennsylvania have given $95,000. Members resident in the remainder of the country have not yet made any general or generous response.

The offer of Mr. Carnegie which led to the indebtedness of the Institute was submitted to the members thereof, and was accepted by a vote of 99¼ per cent. of the members who recorded their acceptance or refusal. The members of the Institute having gone into this thing, they ought to pay for it. There are 3500 members who pay dues. The sum of $21.14 paid in cash by each member would liquidate the outstanding indebtedness of $74,000. The same result would be accomplished by the promise to pay $4.71 per annum for five years.

It would be visionary to expect that every one of the 3500 paying members will now do his duty. Many of them are young men who are not in a position to shoulder any additional financial burden at present. Some of the older men, also, will no doubt have good reason for standing aloof. It is not unreasonable, however, to expect that 1750 members of the Institute can make a subscription of $10 per annum for five years or $50 in cash without great inconvenience. We think that this ought to be done. It has all along been our opinion that the members of the Institute ought themselves to pay the debt that they incurred, and ought not further to rely upon the generosity of outsiders or of some few members, or expect it, or even ask for it.

Dr. Douglas, and the great mining and commercial interest that he leads, have been among the large donors to this fund, and no one is better entitled than he to issue such a circular and appeal as he has just sent out. We urge upon members of the institute to make a prompt and generous response. They should pay their debts *pro rata* and should be too proud to let others do it for them.

## The Steel Trust Investigation

The Stanley committee, appointed by Congress to investigate the Steel Corporation, has submitted a report, or rather reports, which hardly seem to come up to the level which might have been expected from the time employed in the work. As has been noted from time to time, the evidence taken by the committee brought out little or nothing that had not already been known for a long time. Beyond some expressions of individual opinions, more or less interesting, there was very little that was not already on record. The report itself does not seem to be of very much importance, largely for this reason. The committee divides chiefly on political lines, the majority finding that the Steel Corporation aimed at a monopoly in the trade, and that its object—or one of its objects—was to control the trade by absorbing and controlling the supply of raw materials. Accordingly some action is recommended which takes the form of a bill intended to check and control trust operations. It is hardly worth while at present to summarize or analyze this measure, since it will certainly be much modified before adoption, if it is adopted at all.

The minority of the committee also submits a measure, but it is not at all likely to find favor. It provides for regulation of a sort, adopting Judge Gary's idea of fixing prices by some government bureau, or court. The course of the iron markets for the past six months is a pretty good argument against this measure, and it is not at all likely that we shall be called on to turn over the control of this important business to the government just yet.

It is not probable that either of the proposed measures will be taken up or discussed at the present session of Congress, which is already overweighted with the necessary appropriation bills. The whole matter will go over to the short session, which begins next December, and will possibly be further postponed

## Wages at Butte

The newspapers estimate that the increased wages recently granted at Butte, Anaconda and Great Falls on the basis of 17c. for copper will cost the companies about $2,225,000 per year. We are unable to verify that estimate, but it does not look unreasonable. The difference between 14c. and 17c. for copper on 300,000,000 lb. of production is $9,000,000. The companies get about 75% and the men about 25%, other things remaining equal, which is not unfair. The troublesome uncertainty is about other things remaining equal.

According to one press dispatch: "Anaconda officers say this increase will soon be wiped out by benefits from new economies being employed, and others that are constantly being introduced. They are also confident that the company will get better results from the miners by reason of the increase in wages."

These remarks exemplify one sound and one unsound idea in practical economics. Labor is the residual claimant upon production. After the competitive requirements of capital and all other charges have been satisfied, all the rest goes to it. Capital and brains introduce new economics, benefit temporarily, pass on the benefit, and try to repeat the process.

It is unsound, however, to expect that increased wages produce better results in efficiency, etc. Experience has shown the contrary. This is explained by human nature, which largely permeates economics anyway.

The advances in copper have been accompanied by increases in price in several of the minor metals. Aluminum has been raised by the foreign convention, and antimony also is higher than for two years past, owing to a more active demand.

# Correspondence and Discussion

**Views, Suggestions and Experiences of Readers**

## Caving System of Mining in America

The caving system, although I believe originally introduced from the north of England iron-mining districts, has apparently been greatly developed and improved in America and exceedingly low costs are quoted as the result of mining under this system. In Australia this method of mining has not so far been introduced into any mine and I unfortunately have not been able to inspect any mine working under these conditions, but have been interested in reading all the papers written describing the various methods adopted. As doubtless there are many mining engineers similarly situated, interested in the system and anxious to fully appreciate its advantages and disadvantages and the conditions that are necessary for its successful application, but unable to visit places where it is in use and therefore dependent upon writers' descriptions, perhaps a criticism of the system, bringing out the details upon which so far I have been unable to acquire definite information, may lead some engineer to take up these points more fully and give the profession a paper which I am sure would be both interesting and instructive to many of us.

### The Pewabic Caving System

I have before me descriptions of three methods of caving: The first is that described by W. H. Storms in his book "Timbering and Mining." It is the method used at the Pewabic mine in Michigan. This method consists in blocking out the orebody in blocks measuring 250 ft. along the strike by crosscuts driven from a main traveling way in the hanging wall of the deposit. From these crosscuts raises are put up 50 ft. apart, to within 20 ft. of the caved ground above and from the top of the raises drifts are driven across the deposit, immediately above the original crosscuts upon the main level. By underhand rill stoping a cut is then taken eight feet wide right down to the main level cutting the orebody from wall to wall. While these two end cuts are being made a sill cut is being mined across the whole of the block, leaving only pillars to protect the main level crosscuts and sufficient pillars under the block to support the ore and insure the safety of the men. When this work has been completed, the supporting pillars are first robbed as far as it is safe to go, and then the pillars are bored and all the men having been withdrawn from the section, the shots are fired and the ground caved. After the ground has settled, properly closely timbered drives are pushed into the caved ground and the ore is mined by allowing the crushed orebody to run into the crosscuts through the opening in the end or breast of each. The following questions arise: Why are the raises, and therefore the cuts isolating the ore to be caved, only carried to within 20 ft. of the caved ground? With a stope only eight feet wide it should be possible without much inconvenience to carry this cut up to the caved ground and support the roof with stulls while the ground would cave more readily and evenly if the cuts were carried right up.

### Nature of Orebody Important

What is the physical nature and hardness of the ore? It would appear that the ore must be homogeneous in character, not intersected by dikes or planes of weakness and be fragile. It must be good-standing ground to allow of the mining of the sill cut leaving pillars small enough to be mostly blown out with the one firing. To what height is the sill cut taken? Apparently to not more than 10 ft. and, therefore, unless the ore is of a fragile nature, the settlement of a block 100 ft. thick a distance of 10 ft. would hardly be sufficient to crush the ore so that "80% of it will pass a 3-in. opening." This system must depend upon the physical nature of the orebody and it would be interesting to know within what degrees of hardness this system is considered suitable.

The name "caving" for this class of mining seems to be unfortunate because apparently the success of the system must largely depend upon the crushed ground not forming caves. It must be essential that both the crushed ore and the overburden should readily follow the mining operations and keep replacing the ore removed by shoveling and not allow the formation of large cavities in the crushed zone which, upon eventually breaking, would suddenly crush down upon the levels and be a source of danger to the men and drifts. How is this guarded against and are any precautions taken, such as the regular measurement of the subsidence on the surface, to enable the manager to be warned in time to prevent accidents?

### Cave May Form While Crushed Ore Appears in Drifts

It is quite possible for the crushed ore to be appearing at the face of the drift and still for a cave to be forming some distance above, assisted by the jambing of some rocks and a subsequent arch action developing. As the weight of the overburden and caved worthless material has apparently much to do with the success of the process, by the pressure and crushing action they exert upon the settling ore, what depth of overburden is considered advisable or necessary? Is it customary to keep filling up the surface depressions formed by the settlement of the ground with suitable material that will not bind but will follow up the settlements so as to increase the weight and therefore the crushing effect of the overburden?

In removing the caved ore it is allowed to run on to the floor of the drifts and then is shoveled into trucks. Is it not possible largely to cut out this shoveling by erecting chutes in the end of the drift so that the broken ore can be run directly into trucks? If the caved ground is so crushed that 80% will pass a 3-in. opening it should be possible to handle this crushed material through suitable chutes to minimize the shoveling. If handling of the material is desirable to facilitate a certain amount of hand picking could not this be done to better advantage on the surface by means of a sorting belt or at any rate the broken ore be allowed to run on to a platform situated on a level a little above the top of the trucks when at least the action of lifting would be eliminated? To facilitate this it would appear that it might be easier to drive the crosscuts necessary for the removal of the broken ore, not actually in the caved ground itself but just below it so that the sides of these drifts would be protected by solid ore and only the roof would require careful timbering. It would then be possible to put up sloping chutes from the sides of the drifts into the caved ground, so placed that they would deliver direct into trucks.

The increased cost of driving these crosscuts in solid ore would surely be counter-balanced by the saving of timber and reduction of maintenance costs. It is probable that this method is either in operation at some mine or has been tried and found unsuitable. In either case it would be interesting to have a description from some engineer who has tried it with

a comparison of its advantages and cost with the described method of running the crosscuts wholly in the caved area.

### System Has the Advantage of Safety

This system as described seems an excellent one and has the advantage of great safety for the men, as its only dangerous period is when the pillars of the sill cut are being reduced before caving, and a little experience should enable the manager to do this work without running any big risks with his men. As the suitability of the system depends almost wholly upon the physical nature of the ore, some careful description of the various ores, which those operating the system consider are suitable for caving, would be extremely useful.

The second method is the top-slice method of caving. This might be described as a retreating longwall system of mining with the disadvantage that instead of having a fairly sound roof, which can be worked to bring a suitable pressure upon the ore to assist in its mining, the roof consists of caved ground. It is rather difficult, with the information available, to appreciate how such low costs as quoted are obtained. Is this class of caving only suitable for such soft ore that it would be impossible to mine out a sill cut as described in the first method? Unless the ore is very soft the great drawbacks to this system must be; all ore is mined from the solid; it must be necessary to advance the crosscuts, by which all the ore is mined, by some system of spiling and all timber must be kept close to the face; an excessive amount of timber must be required, none of which is apparently recovered. It would be interesting if from some mine using this system a statement could be procured giving the quantity of timber required per ton of ore extracted. It looks as if it would be heavier even than in the square-set system of timbering, which is extravagant enough in timber. It must be difficult to have efficient transport of the ore to the chutes as the continual shifting of the lines will not make it worth while to expend the time necessary to lay down a good track, which is necessary for the expeditious and cheap handling of big tonnages. It is claimed that the ventilation is good. This requires an explanation as the bare statement does not carry conviction with it and it is hard to see, from the description I have before me, how the ventilation can be other than bad; how mining by drifts driven from the top of blind raises and connected in no way to higher levels can be good certainly needs explanation. This system can hardly be called "the caving system of mining" but should rather be alluded to as "the caving system of filling," as it will be noticed that none of the ore is actually caved but is mined from the solid and after its extraction the roof is allowed to cave in to fill the empty stope instead of trying to support the roof either by timber or by the introduction of filling. This system must surely be much more limited in its application than that first described.

### Sub-level Caving Systems

The third method is the sub-drift variation of caving. This system consists of blocking out the ore upon the main level into blocks about 50 ft. square. At 50-ft. intervals along these drifts and crosscuts raises are put up to the caved ground above and from the raises, at vertical intervals of from 12 to 15 ft., sublevels are driven until eventually the whole block of ore is honeycombed by a series of horizontal and vertical passages. When this stage has been reached the actual caving is begun working from the top downward. The ore above the sublevels is allowed to fall by the removal of the timber and is then shoveled away, the caved filling being temporarily supported by spiling and posts. The pillars are removed by the top slicing in a manner similar to that already described.

In this method about 40% of the orebody must be removed by raises and drifts, generally the most expensive method of mining, while of the remainder all that contained in the pillars has to be mined from the solid under a roof formed of caved ground. This seems to show that the method is only suitable for soft ore which can be cheaply driven through and requires practically no boring or explosives. Otherwise, it is hard to see how the low costs quoted can be obtained. This system must also require a large quantity of timber and it would be useful to know the quantity per ton. Not its cost per ton as the cost of timber varies so on different fields.

### Adaptability of Various Methods

The following conclusions appear to be sound from the information available:

Caving by the first method depends upon a depth of overburden sufficient to crush the undermined ore by its weight and also of such a nature that it will settle evenly and regularly. That the ore must be of such a nature that upon settling 7 to 10 ft. it will break up through a depth of 100 ft. and assisted by the weight of the overburden in a comparatively short time will crush into pieces of moderate size. Under these conditions it appears to be an ideal method of mining. For the general profession a careful description of the ores that have been found by experience to answer these requirements is much to be desired.

Caving by the top-slice modification does not depend at all upon the weight of the overburden to assist in the mining and therefore can be used on shallow deposits. The ore must be very soft and easy of extraction or the expense of mining the whole of the orebody from the solid would not allow it to compete with other methods. Timber must be cheap in the district.

Caving by sub-level, not depending upon the assistance of overburden in crushing the ore, can be used in shallow deposits but in common with others this method requires that the overburden should settle readily and rapidly after the extraction of the ore. The ore must be soft and easily excavated as such a large proportion of it has to be mined from the solid; and not be of such a nature that it will readily break up upon settlement as otherwise the first method described would surely be much cheaper. Timber must be cheap and also I should say of a soft variety. From the experience I have had in Australia in driving through collapsed stopes containing hard wood, I should say that it would be impossible to mine with a reasonable degree of cheapness under a mat consisting of broken overburden and sticks of iron-bark or other hard wood.

I trust that if these conclusions of mine are wrong that some engineer using the system will correct them and also give some more information about the physical character of his orebody.

J. Bowie Wilson.

Sydney, N. S. W., Apr. 12, 1912.

## Colorimetric Copper Assay

The article on copper determinations at Granby by Frank E. Lathe, in the Journal of June 1, 1912, seems to me an excellent resumé of the best modern practice. Referring to his colorimetric method for copper in slags I notice that he finds a difference in color between standards and assays containing the same amounts of copper and also that he adds iron and aluminum to his standards to make conditions the same as in the assays.

For some time I have been using this method in a way which overcomes both of these difficulties and makes the conditions under which standards and assays are run almost identical. Several typical slags are procured varying in percentage of copper within the limits of the required standards. Careful copper determinations are made on these slags and then relative amounts are weighed out for the standards and treated exactly the same as the assays. The colors will be found to be exactly the same in standards and assays and all other conditions are practically the same in both cases. The method used in this way will be found satisfactory and is useful for rapid copper determinations on daily slags.

R. L. Hallett.

Brooklyn, N. Y., July 30, 1912.

# Geology Applied to Mine Examination

By Ira B. Joralemon*

**Geology is nearly always the determining factor in an examination of a prospect or partially developed mine, where the extent of mineralization, level of ground water and depth of enrichment must be judged from surface indications.**

*Geologist, Calumet & Arizona Mining Co., Warren, Ariz.

Note—A paper presented before the Phelps-Dodge Geologic Conference, at Morenci, Ariz.

The purpose of a mine examination is to determine whether or not it is worth while to invest money in a mine or prospect. From the nature of his work, the examining engineer must take a much more commercial point of view than either the prospector or the geologist in charge of underground exploration. In planning exploration, the geologist tries to find all the available ore in his mine, without estimating the actual profit on the money invested in the property which that ore will give his employers. The prospector must have an unquenchably optimistic disposition, which will imbue him with a strong and often a blind faith that he will find a great mine, or he would never adopt so uncertain a calling. The examining engineer, however, must secure for his employers a good return on the money invested, or forfeit his position.

### Relation of Expectation of Profits to Risks

Few mining investments are safe, and the possible profits from a venture must increase with the degree of uncertainty. In the rare case where the mine has ore enough developed or fairly well indicated to make possible an estimate of the total output, the engineer may be satisfied with a moderate profit, and may safely pay a large cash price for the property. In the more usual case where the result of the speculation is doubtful, the possible return, if the mine turns out well, must be many times the amount invested, and cash payments must be avoided.

It is important that the examining engineer accomplish his task as rapidly and with as little expense as possible. The cost of examination of many properties must be paid by the few that are taken. If a high purchase price, inaccessibility, or any other condition proves in a short time that it is out of the question to buy a mine, the engineer is not justified in making a thorough examination, no matter how interesting the locality may be from a geologic standpoint. Usually the work is rather a reconnoissance than a careful study.

The examining engineer then must balance the possible profit in case the mine proves to be a good one against the chance of failure, to determine if the speculation is worth making. One good mine will pay the cost of a dozen failures, and it is far better to suffer a dozen disappointments than to let slip a possible Bisbee. To condemn a good mine is the cardinal sin of the examining engineer. Since unexpected types of deposits are constantly being discovered, any examining engineer of great experience is a hardened sinner. To avoid this sin as much as possible, he must risk his reputation and his employer's money wherever there is a reasonable chance of success. He must prepare his pride for many failures, and must rely on the laws of chance to bring him out a winner in the long run.

### Examinations are Made on Three Types of Properties

The properties on which examinations are made fall naturally into three classes. The commonest are the undeveloped prospects, or those on which a little work has been done with negative results. In determining the values of these properties, geology is the only guide. Such examinations are closely akin to the work of the prospector.

The second class of properties includes the partly developed mines, in which ore enough has been found to give some idea of the nature of the ore occurrence. Here also geologic inference is the chief factor in determining the value of the property. The examination of partly developed mines is more like the work of the geogolist who plans mine exploration.

In the third class belong the fully or nearly fully developed mines. In examining these geology is of comparatively little use. Frequently, however, the geologist may find chances for new ore which have been overlooked in the development of the mine.

The methods of procedure in these three cases differ, and each case may be considered separately. I refer in this description chiefly to the examination of copper properties, though the methods apply with a few changes to all metal deposits.

When examining an undeveloped copper district, the first thing to look for is a widespread and thorough mineralization. Where there has been mineralizing action strong enough to form important orebodies, it is almost certain that this action will have had a great effect on the rocks over a large area. In the greater part of this area the mineralization is usually too slight to make commercial ore. It may take the form of pyritization with surface iron staining of a large mass of igneous rock or schist; of seams of copper-stained iron oxides in limestone; of interlacing or parallel veinlets far from a large vein, or many other forms. However promising the smaller outcrops may be, I consider it very unlikely that they will develop into great mines unless there is some such general mineralization. The Southwest is strewn with outcrops of rich ore or of fine gossan on which fortunes have been spent only to prove them gash veins or shallow surface deposits which have not paid the cost of development. There may be important vein deposits accompanied by comparatively little mineralization of the walls, with no smaller veins leading from the great one. In the case of copper deposits at least, it is safer to let someone else pay for developing such solitary veins. In all the great mining districts of the Southwest, the mineralization extends with decreasing strength for several miles from the center of the district. Without such general and thorough mineralization, I do not consider a copper property worth developing.

Where the general conditions are favorable, there is a fair chance that valuable ore deposits exist somewhere in the district. The next task for the examining engineer is to determine what the nature of these deposits is likely to be. Here he must rely on the similarity of geologic conditions to those in developed districts. For this work, it is most important that he be familiar with many deposits of all types. He must judge from his experience whether the ore in the new region is likely to be in veins, contact or replacement bodies, disseminated deposits, or in any other forms of ore occurrence. With this accomplished, he can concentrate his more detailed work on the smaller area in which ore is likely to occur.

### Limestone Resembling Gossan Outcrop

The extent of the area in which ore may be expected should next be determined. Often it will be found that this locus of the orebodies is too small to contain a large mine. For instance, it is common in the Southwest to find floating in porphyry small blocks of limestone, the remnants of sedimentary deposits that have been almost entirely eroded away. Often these blocks are long and narrow, the bottoms of synclines or of V-shaped troughs formed by dropped fault blocks. Such narrow limestone masses are the "lime dikes" of the prospector. Since all parts of the limestone are near porphyry

contacts, there is an excellent chance for contact metamorphism. Often the whole mass of limestone is changed to iron oxides and lime and iron silicates, with abundant copper stains and seams of carbonate ore. Some of the finest gossan outcrops I have seen are of this nature. They are often pointed out as the outcrops of fissure veins, and where the bands are so narrow that none of the limestone structure can be seen, it is easy to mistake their true origin. The geologist may determine whether the outcrops are vein material or the result of metasomatic action, and may save his employers the chagrin of finding barren porphyry a few feet below a magnificent gossan outcrop.

In many other ways the locus of the possible orebodies may be too small to harbor a mine. Few properties will pass the examination even to this point, the beginning of the real work.

### Primary Ores Seldom of Commercial Grade

Two main problems must now be attacked—the nature of the primary mineralization and the probable degree of enrichment. While there is commercial primary ore in many great mining districts, it is not safe to figure on primary ore in buying an undeveloped property unless great quantities of this ore are exposed on the surface. This I have never known to occur. The importance of knowing the character of the primary mineralization lies in the indication that knowledge gives of the amount of concentration which will be necessary for the formation of commercial ore.

Material which has escaped leaching or enrichment may be found on the surface in areas between shear zones, or in the bottoms of rapidly-cut gulches. If this material is of such a nature that with surface alteration it might form the nearby outcrops, and yet is entirely barren, there is not likely to be ore under the outcrops. For instance, if a mineralized and leached shear zone grades in a cañon into fractured, pyritic porphyry with no trace of copper, it would be almost hopeless to try to find a copper mine in the shear zone. But if the pyritic material assayed ½% copper, it might easily be enriched to a commercial ore. Thus, though the primary ore near the surface is seldom of commercial grade, it is most important to determine the nature of this ore.

Even if no primary ore can be found, some idea of the character of the mineralization may be obtained by a close study of the outcrops. Here, too, it is essential that the examining engineer shall have become familiar with many different ore deposits. The resistance to erosion of an outcrop, its color, mineral composition, physical structure, and the relative amounts of different constituents, all give valuable clues to the nature of the primary ore and also to the strength of the surface alteration. An excellent paper on the outcrop of orebodies, by W. H. Emmons, was published in two numbers of the *Mining and Scientific Press* in December, 1910. This subject is greatly neglected in the literature of geology, and information on it can usually be obtained only by searching through long descriptions of mining districts, or through articles on superficial alteration. Experience is the only trustworthy teacher of the meanings of outcrops, and even experience often leads astray those who put too blind a faith in its virtues.

The last step in the examination is the study of the leaching and of the probable enrichment. This involves a study of the nature of the gossan, the ground-water level and its movement, the rapidity of erosion, the character and permeability of the rocks, and the fracturing. And these must be determined from surface conditions alone, with little or no assistance from underground workings.

### Worth of Mine Dependent Upon Extent of Enrichment

The ground-water level often cannot be located from surface indications. Yet the examining engineer must express an opinion on the value of the property, which value depends largely on the amount of leaching and enrichment. In such cases he must adopt some working assumption on which to base a decision which will be fairly safe without being too conservative. I have considered it safe to assume that in the smaller, desert mountain ranges the water level will be at least as low as the floors of the surrounding large valleys, while in large mountain ranges the level may be considerably higher than the bottoms of the main cañons.

The rate and direction of change in the water level can seldom be discovered certainly from surface indications. The rapidity of erosion is the best evidence, though occasionally a study of faulting may give a clue to great and rapid changes.

Whether or not the leaching and consequent enrichment have kept pace with a sinking water-level can usually be determined fairly easily. When erosion has been very rapid, primary sulphides are generally found near the surface. The character of the rock and the degree of fracturing in it indicate the ease or difficulty with which it may be leached. If there is even slight fracturing limestone is usually oxidized to the water level, or at least deeply, while the fine-grained igneous rocks require very thorough crushing to allow much leaching. The color and nature of the outcrop may give an idea of the strength of surface alteration. Large amounts of copper carbonate or silicate on the surface generally indicate that leaching and enrichment will be shallow at that point. Many such indications help convince the geologist whether or not the primary ore is likely to have been enriched into large workable orebodies.

The process of examination has been one of elimination, leaving at the end only properties in regions thoroughly mineralized, where the locus of the orebodies is great enough to allow large deposits, where outcrops are large and promising, where the primary ore contained the metal sought for in appreciable quantities, and where the conditions of water level and enrichment are apparently such that this primary ore may have been concentrated into orebodies of commercial grade. When a property has passed these tests, the engineer may proceed to the question of whether or not the chance of finding a mine justifies the payment of the purchase price and the cost of development. After a few disappointments, when beautiful surface showings have covered ore too low-grade or too refractory to mine, the engineer becomes unwilling to make cash payments on undeveloped mines.

### Character of Primary Obtained from Enriched Ore

In examining partly developed properties, the work of the examining engineer closely resembles that of the geologist who plans exploration work. He makes a study of the occurrence of the developed orebodies and of the outcrops which represent them, and from this determines what is likely to be found in the rest of the property. The points which were uncertain in the examination of the undeveloped properties are here far clearer. The water level is usually either developed or shown to be so deep that much enrichment is possible above it. The actual depth of leaching and the character of the enriched ore are almost always proven. The character of the primary ore can usually be determined either through exposure below the enriched zone or by a study of the composition of the enriched ores. Thus the engineer finds out how the ore in the new district occurs.

The determination of the probable limits of partly developed ore is most important. Where the thickness of enriched ore is not proven, a fair idea of this thickness may sometimes be obtained by reasoning from the value of the primary ore, the value of the enriched ore, and the depth of leaching. Often, however, rapid erosion of the leached material makes such reasoning invalid. Where the character of the primary ore is indicated only by the enriched ore, the problem becomes a difficult one. How much of the value of an enriched ore is due to the enrichment is always hard.

and often impossible to determine. In some mines it seems likely from the nature of the enriched ore that the primary ore will be rich enough to mine and that the ore will continue to great depth. Other conditions too may make possible a good guess as to the limits of the ore. An orebody is often bounded on one side by a fault, and the geologist may become convinced that part of the orebody is beyond the fault. By all possible means he should try to ascertain the amount of ore that may reasonably be expected in the area developed or partly developed.

Having studied the developed orebodies, the examining engineer returns to the surface and determines the areas in which conditions for ore deposition should be as favorable as in the proven ground. Knowing the amount of ore below certain outcrops, by comparing other outcrops with these he may form a fairly reliable opinion on the ore that may be expected in the property.

Often, however, there is a chance that there may be ore of a different character from that developed. If ore has been found in limestone near an intrusive contact, there may be disseminated ore in the intrusive rock. By hunting for such possibilities, the geologist may find that the mine has a possible value far greater than the developed orebodies indicate.

### The Limit of Amount of Cash Payment

After forming his opinion of the probable value of the mine, as in the case of the undeveloped property the engineer compares this value with the purchase price and the cost of development to determine whether he can recommend buying the mine. Here it is seldom safe to make a cash payment much greater than the probable profit from the ore already developed.

In the third case, where properties are fully developed, the work of the examining engineer becomes the purely mathematical problem of measuring the ore, figuring the profit from it, and determining whether this profit will pay the purchase price, interest, and amortization charges. Fully developed mines are very rare, however. In nearly every property the geologist can discover a possibility of more ore. Unless there is a chance that the real limits of the ore have not been reached, or that there may be new orebodies of a different sort, the geologist will find little to interest him in the examination.

Such is the general procedure in making mine examinations. Geology is nearly always the determining factor. But with the most careful geologic work, the results of the examination will be unreliable unless there are added two unusual qualities, good judgment, and breadth of vision. These qualities are rather inherent than acquired, and by their aid engineers with scanty geologic training are often more successful in examination work than the most thoroughly trained geologists.

By the very nature of his work, the examining engineer is more or less of a pioneer. New types of deposits are constantly being brought before him. If he is prejudiced in favor of any one theory of ore deposition, or if he relies too much on the universality of the types of deposits with which he is familiar, he will miss the possibilities of fields where his theories will not apply. He will see mines that he has condemned spring up to mock his prejudices. Nature is many sided, and the one-sided man misses much of her greatness.

The examining engineer must be always ready to accept new conditions, yet must have the judgment and insight that determine whether the chances of success are good enough to warrant testing the conditions. With careful geologic work, supplemented by good judgment and breadth of vision, he may have the satisfaction of bringing new mines and new types of deposits to productiveness, and may secure lasting prosperity to those by whom he is employed.

## Volumetric Method for Thorium

A volumetric method for thorium has been worked out by Metzger and Zons (*Journ. Ind and Eng. Chem.*, July, 1912), which depends on the precipitation of thorium with a standard solution of ammonium molybdate, an excess of the precipitant being shown by the use of diphenyl carbazide on a spot plate.

The method as appied to monazite sand is as follows: Treat 1.0 gram of the powdered sand in a porcelain crucible with 10 to 15 cc. concentrated $H_2SO_4$. Heat several hours, then cool and transfer crucible contents, a little at a time, to 700 cc. of water cooled to nearly 0°C. Allow to stand several hours (over night if convenient), to insure solution of the sulphates. Filter and wash.

Nearly neutralize the filtrate with ammonia, and add 50 cc. of a cold saturated solution of oxalic acid. Allow to stand over night, filter, and wash the oxalate precipitate with dilute oxalic acid. Transfer precipitate and paper to a beaker, and add 20 to 25 cc. of strong potassium-hydroxide solution and heat to boiling. Dilute, filter, and wash with hot water.

Dissolve the precipitate of rare-earth hydroxides off the filter with hot dilute nitric acid, and evaporate to dryness on a water bath. Add a few cubic centimeters of water and again evaporate to remove free acid. To the dry residue add 200 cc. glacial acetic acid, dilute with 300 cc. of water, add one gram of sodium acetate, and stir until dissolved. The excess of acid holds up other rare-earth molybdates.

Titrate at room temperature with standard ammonium-molybdate solution. The standard solution contains about 20g. per liter of ammonium molybdate, but must be standardized on a known thorium salt. The ammonium molybdate should be added a few tenths of a cubic centimeter at a time, with a vigorous agitation after each addition, finally finishing drop by drop. The end point is reached when a drop of solution produces a pink coloration on the spot plate, with a drop of diphenyl carbazide.

The diphenyl carbazide is prepared as follows: Add 23 grams of phenyl hydrazine to 7 grams of urea in a flask, and heat in an oil bath at 160 to 170°C. for six hours, using a reflux air condenser. Allow to cool, add 50 cc. ethyl ether, heat on a hot plate for one hour, decant and add 50 cc. more ethyl ether and heat for two hours longer. A white precipitate remains. Purify this by dissolving in alcohol and reprecipitate by addition of an excess of water. Repeat this purification. Filter on a Büchner funnel, wash and dry at 105° C. The yield is about 14.3 grams of diphenyl carbazide.

This is white when first precipitated, but turns brownish-yellow in time. A trace of impurity causes it to turn pink, hence all vessels used must be scrupulously clean. The indicator, when on the white tile, should be yellowish or brownish yellow. It is necessary that this indicator be at least two weeks old before using, as the freshly prepared solution requires a large excess of molybdenum to produce a pink coloration.

## Antimony a Byproduct Only

Information received by the U. S. Geological Survey indicates that no antimony ore was produced in the United States in 1911, but considerable quantities of antimonial lead were made as a byproduct in smelting the precious metals. There was also a large recovery of antimony from secondary sources, such as scrap bearing and type metals, antimonial lead, drosses, and solder; 14,078 tons of antimonial lead containing a total of 2254 tons of antimony, were produced. The price of antimony was so low in 1911 that there was little encouragement for American miners to produce the ore unless it contained other valuable metals.

The production of secondary antimony as antimony in the United States last year was 10 short tons; and 2359 tons was recovered in alloys. In 1910 the recovery was 9 and 2770 tons, respectively. Antimony is used principally in antimonial lead as type metal and as babbitt and other bearing metals.

## Operations at Goldfield Consolidated for June 1912

During the month of June, 1912, the total production of the Goldfield Consolidated Mines Co. was 32,365 tons, containing $573,658, or an average of $17.72 per ton, of which 29,040 tons was milled with an average extraction of 92.63%, and 3325 tons was shipped of an average assay of $23.91 per ton. The net recovery from all ore was $16.60 per ton. The total net realization to the company was $325,475, or $10.06 per ton.

The total cost of mining, development, transportation, milling, office and general expenses was $6.82 per ton, distributed as shown in the accompanying table:

OPERATING COST, GOLDFIELD CONSOLIDATED MINES CO., FOR JUNE, 1912

| | | |
|---|---|---|
| Mining: | | |
| Development | $0.79 | |
| Stoping | 2.51 | |
| | | $3.30 |
| Transportation | | 0.08 |
| Milling | | 2.03 |
| Marketing | | 0.06 |
| General expenses | | 0.47 |
| Bullion tax | | 0.12 |
| Marketing ore shipped | | 0.70 |
| Construction | | 0.06 |
| Total cost of operation | | $6.82 |
| Miscellaneous earnings | | 0.06 |
| Net cost per ton | | $6.76 |

RESULTS OF DEVELOPMENT

Supt. J. F. Thorn reports that the stope in the Reilly vein of the Combination mine, southeast of the shaft, produced 1341 tons of $22 ore. The 402-G stope, 300 ft. north of the shaft, between the fifth and sixth levels, produced 353 tons of $ 8 ore. This is the deepest place in the mine where ore has been found. A new stope is being opened on the second level, 200 ft. east of the 136 stope, under the old January workings; 102-X and 103-X drifts, driven through the quartz, produced 117 tons of $15 ore.

At the Mohawk, the work being done north of the 3 stope on the 150-ft. level through the old Sheets-Ish country, is proving a large tonnage of good-grade ore. The 3-J sill, 50 ft. north of the 3-E stope, produced 43 tons of $37.60 ore. The 29 drift, being advanced north in the foot wall of the Sheets-Ish stope, produced 38 tons of $31 ore. The 170-L stope, on the 250-ft. level, produced 105 tons of $28 ore. The 111-N, on the 250-ft. level, under the Hayes-Monnette stope, produced 354 tons of $40 ore. The 354-Q, in the foot-wall section of the 354 stope, produced 1389 tons of $43.20 ore.

At the Clermont, the 426-X intermediate, between the 750- and 600-ft. levels, and close to the old 401 stope, produced 108 tons of $28 ore. During the last month the development on the 1300-ft. level on the Grizzly Bear has been satisfactory. The 802 drift in the orebody has been shipped as broken, the last round of muck averaging $64 per ton. The third compartment of the shaft from the 1300- to the 1000-level was completed, and pipes, ladders and electrical equipment moved over. Guides were put down the former manways from the surface to the 1300, and a double-drum electric hoist installed on the surface. Sinking the next lift of 140 ft. is now in progress.

## July Mining Dividends

July is, in the mining as in the industrial world, a month of large dividend disbursements. Thirty-seven United States mining companies report to the JOURNAL dividend disbursements of $6,888,977; metallurgical, coal, iron and holding companies, $3,748,605; and Canadian and Mexican mining companies, $1,658,156. There are three new names in the list, Gold Chain, of the Tintic district, Utah, Pittsburgh-Silver Peak, of Nevada, and Seven Troughs Coalition, as well as a number of returns after long absences, in which class are Tonopah Extension, Colorado Fuel & Iron, Le Roi No. 2, and Consolidated Mercur.

| United States Mining Companies | Situation | Per Share | Total |
|---|---|---|---|
| Ahmeek, c | Mich. | $5.00 | $250,000 |
| Am. Z. L. & S., z.l | U.S. | 0.50 | 81,640 |
| Anaconda, c | Mont. | 0.50 | 2166,250 |
| Bing-New Hav. c | Utah | 0.10 | 22,869 |
| Bunker Hill & Sull., l.s. | Ida. | 0.20 | 65,400 |
| Center Creek, z | Mo. | 0.05 | 5,000 |
| Champion, c | Mich. | 1.00 | 100,000 |
| Continental, z.l | Mo. | 0.50 | 11,000 |
| Con. Mercur, g | Utah | 0.03 | 30,000 |
| Cop. Range Con., c | Mich. | 0.05 | 196,723 |
| Daly-Judge, s.l | Utah | 0.15 | 45,000 |
| Daly West, sl | Utah | 0.30 | 54,000 |
| Fremont, g | Calif. | 0.02 | 4,000 |
| Frontier, z | Wis. | 2.00 | 5,000 |
| Gold Chain, g | Utah | 0.02 | 20,000 |
| Golden Cycle, g | Colo. | 0.02 | 30,000 |
| Goldfield Con., g | Nev. | 0.30 | 1067,074 |
| Hazel, g | Calif. | 0.01 | 9,000 |
| Hecla, l.s | Ida. | 0.02 | 20,000 |
| Homestake, g | S.D. | 0.50 | 109,200 |
| Iron Blossom, s.l.g | Utah | 0.10 | 100,000 |
| Mary McKinney, g | Colo. | 0.02 | 26,185 |
| New Idria, q | Calif. | 0.30 | 30,000 |
| North Butte, c | Mont. | 0.50 | 205,000 |
| North Star, g | Calif | 0.15 | 37,500 |
| Old Domin, M. & S., c | Ariz. | 1.25 | 205,000 |
| Opohongo, g.s.l | Utah | 0.02 | 17,980 |
| Osceola, c | Mich. | 6.00 | 576,900 |
| Portland, g.s | Colo. | 0.02 | 60,000 |
| Pitts.-Silv. Peak, g | Nev. | 0.16 | 288,000 |
| Seven Troughs Coal,. g | Nev. | 0.02½ | 37,500 |
| Tonopah-Belmont, g.s | Nev. | 0.05 | 375,000 |
| Tonopah Exten., g.s | Nev. | 0.02½ | 23,586 |
| Tonopah Min., g.s | Nev. | 0.40 | 400,000 |
| Wasp No. 2, g.s | S.D. | 0.01 | 5,000 |
| United Globe, c | Ariz. | 4.50 | 103,500 |
| Wellington, g | Colo. | 0.00½ | 5,000 |

| Coal, Iron, Industrial and Holding Companies | Situation | Per Share | Total |
|---|---|---|---|
| Am. Ag. Chem., pfd | U.S. | $1.50 | 275,730 |
| Am. Ag. Chem., com | U.S. | 1.50 | 171,141 |
| Am. Sm Sec. pfA | U.S. | 1.60 | 255,000 |
| Am. Sm. Sec. pfB | Mex. | 1.25 | 375,000 |
| Colo. Fuel & Iron, pfd | Colo. | 2.50 | 50,000 |
| Central Coal & Coke, com. | U.S. | 1.50 | 76,875 |
| Central Coal & Coke, pfd. | U.S. | 1.25 | 23,437 |
| Gen. Chem., pfd | U.S. | 1.50 | 150,000 |
| Guggenheim Expl | U.S. Mex. | 2.50 | 519,833 |
| Nat. Carb., com | U.S. | 1.50 | 82,500 |
| Old Dominion, c | Maine | 1.00 | 293,245 |
| Pittsburgh Coal, pf | U.S. | 1.25 | 371,262 |
| Sloss-Shef | Ala. | 1.75 | 117,250 |
| U. S. Sm. R. & M., com | U.S. | 0.50 | 175,552 |
| U. S. Sm. R. & M., pfd | Mex. | 0.87½ | 425,530 |
| Va.-Car. Chem Co., pfd | U.S. | 2.00 | 360,000 |
| Vulcan Detinning, pfd | N.J., Ill. | 1.75 | 26,250 |

| Canadian, Mexican and Central American Companies | Situation | Per Share | Total |
|---|---|---|---|
| Beaver Con., s | Ont. | 0.03 | 59,989 |
| Brit. Col., c | B.C. | 0.15 | 88,756 |
| Buffalo Mines, c | Ont. | 0.05 | 50,000 |
| Crown Reserve, s | Ont. | 0.05 | 88,441 |
| Dominion Coal., com | Can. | 1.00 | 150,000 |
| La Rose, s | Ont. | 0.12½ | 187,328 |
| Le. Roi. No. 2, g.c | B.C. | 0.24 | 29,160 |
| McKin.-Dar.Sav., s | Ont. | 0.10 | 224,769 |
| Nipissing, s | Ont. | 0.38½ | 450,000 |
| Nova Scotia. S. & C., com. | N.S. | 1.50 | 90,000 |
| Nova Scotia. S. & C., pfd. | N.S. | 2.00 | 20,600 |
| Standard Silver Lead, l.s. | B.C. | 0.02½ | 50,000 |
| Temiskaming, s | Ont. | 0.03 | 75,000 |
| Temiskaming & Hudson Bay | Ont. | 3.00 | 23,283 |
| Wettlaufer-Lor. s | Ont. | 0.05 | 70,830 |

Unfortunately the last is more a subject for gloom than rejoicing, as it is understood to be a liquidation dividend, preparatory to winding up the affairs of the company. Colorado Fuel & Iron had not paid dividends since Feb. 20, 1903, until the declaration of 2½% for July and 2½ for next February. It is to be hoped that this company is now out of its troubles.

Increases in dividends are to be noted by Ahmeek, North Butte, Old Dominion, Osceola and United Globe, reflecting the high prices of copper, while North Star and Opohongo increased their disbursements just as a matter of increased prosperity. The most important change, however, is the reduction in Goldfield Consolidated to a 30c. quarterly basis.

Mining dividends declared by United States companies making public reports amount to $34,582,575 for the first seven months of 1912, and those of mining, metallurgical and allied companies to $97,032,408.

## Chronology of Mining for July, 1912

*July* 1—Butte miners voted to accept wage proposition of Anaconda company to pay $4 per day on the basis of 17-c. copper, to be effective June 1.

*July* 4—An explosion of firedamp in the Osterfield colliery near Oberhausen, Germany, killed 14 miners.

*July* 7—An explosion of dynamite killed 10 and injured two men loading holes in the Eureka pit of the Nevada Consolidated.—At the Braden copper mine, in Chile, 30 men were killed by an explosion underground.

*July* 8—Earthquake shocks felt at Fairbanks, Alaska. A fire in Tonopah destroyed property valued at $250,000.

*July* 9—An explosion killed 88 men in the Cadeby colliery in Yorkshire, England, the day after that mine had been visited by King George V.

*July* 11—An explosion in the Panama colliery of the Ben Franklin Coal Co. at Moundsville, W. Va., killed eight men.—The Arizona Commercial mine was purchased by Charles Smith at public sale for $1,000,000.

*July* 16—Six miners were killed and three were seriously injured in an explosion at the Gayton colliery of the Old Dominion Development Co., about 20 miles from Richmond, Va.

*July* 18—A cloudburst in the Seven Troughs district, Nevada, drowned 13 people and did much damage in the towns of Mazuma and Seven Troughs.

*July* 21—Standard mill of the Amalgamated Asbestos Co. at Thetford, Que., was destroyed by fire.

*July* 24—The new mill of the Tonopah-Belmont company commenced operation.—A cloudburst swept away a dam, drowning 13 men in the Superba No. 2 colliery near Uniontown, Pa.

*July* 25—The smeltery of the Santa Fé Gold & Copper Co. in the San Pedro district, New Mexico was blown in.

*July* 26—Three men were burned in the shaft of the No. 3 colliery of the Monon Coal Co., six miles southwest of Linton, Indiana.

*July* 31—Announcement of the consolidation of the Alaska-Perseverance, Oxford, and Sheep Creek properties near Juneau, Alaska, as the Alaska-Gastineau Mining Co.

## U. S. Borax Production

The U. S. Geological Survey reports a considerable increase in the production of borax for 1911 over that of 1910. The production for last year was 53,330 short tons of the crude material, valued at $1,569,151, and the 1910 production was 42,357 tons of crude material, valued at $1,201,842. California furnishes almost the entire borax product of the United States. The mineral is principally colemanite, a borate of lime. The product as mined varies widely in its content of anhydrous boric acid.

Borax was first commercially produced at Borax Lake and Lake Hachinhama, by evaporation of the lake water, but the method was supplemented by recovering the mud from the bottom of the lake and washing out the contained borax crystals.

The dry-lake borax deposits were discovered later in Western Nevada and contiguous California. Some of the more important deposits of this type are Fish Lake, Columbus, Rhodes, and Teals marshes in southwestern Nevada,—Searles Dry Lake, Cane Lake, Saline Valley, and Death Valley in California.

The borax industry was established practically on its present basis in 1882, when the bedded colemanite deposits were discovered at Death Valley, and the year following at Calico. Since the working of the colemanite deposits on a large scale, the dry-lake deposits have been neglected. Borax is now made exclusively in the refineries of the large companies in California and at Eastern points.

The production of borax for 1911 was the largest in the history of the United States except that for 1906, when the output was 58,173 short tons, but the value of the 1911 production was greater.

## Lime in Cyanidation

By C. E. Rhodes*

The use of lime in cyanide plants is, of course, universal, but there are a number of methods of introducing it into the plant circulation. Each of these is probably most efficient in some special case, but there are few records of definite facts obtained by especially designed experiment. The accompanying facts determined at this mill and for this particular ore may, therefore, be of interest. Doubtless all of the information may be gleaned from the various textbooks on the subject and the article is submitted only as illustrative of our practice with no claim for originality.

### Method of Using the Lime

At this mill all lime is added to the ore before it reaches the mill bin. Unslaked lime is fed by hand to the belt conveyor which delivers the ore to the battery bins. It varies in size from dust to pieces 4 in. in diameter. This method is economical. To handle something over 200 tons of lime per month costs $22.50, or $0.0006 per ton of ore, about 35,000 tons being milled per month. The cost of lime is $6.75 per short ton and it contains approximately 70% soluble CaO. There is no machinery to look after nor power needed and it is easy to increase or decrease the amount of lime in solution. Another advantage is that the lime is in contact with the ore before the cyanicides have a chance to exercise any deleterious effect.

At this plant approximately 10% of a heavy sulphide ore is treated, which is kept in a separate division of the main ore bin and is crushed separately by 10 stamps of the main battery, and the lime is so added that this portion of the ore always contains a large excess of lime.

A possible disadvantage of this system would be the damage to the conveyor belt, but here the lime usually falls upon a bed of ore, or if not, there is always a thin layer of dirt which protects the belt. Damage might result from lime dust getting into bearings, but this objection would apply equally to any dusty ore. The cheap Mexican labor could not be obtained at all plants, and handling lime every day for from 8 to 12 hours is a rather disagreeable task.

A series of experiments was made by A. B. Myers at this plant, to determine the effect both as to extraction and cyanide consumption by using different quantities of lime. The first four experiments started with: (1) One pound lime per ton solution. (2) One and one-half pounds lime per ton solution. (3) Two pounds lime per ton solution. (4) Two and one-half pounds lime per ton solution. All were given 36-hr. agitation in small cones and no lime was added to the tests, shown on the next page.

*Cyanide superintendent, El Oro Mining & Ry. Co., El Oro, Mexico.

### Effect of Lime on Extraction and Cyanide Consumption

It will be noted that up to 2 lb. of lime, the total extraction increased, and the cyanide consumption decreased with the increased quantity of lime, and that in every case all the lime had been neutralized at the end of the 36-hr. agitation; also that in the first three tests reprecipitation had taken place after the protective alkalinity had been destroyed, while in the fourth test there was a slight increase due, probably, to the fact that while the protective alkalinity had been destroyed, enough time had not elapsed to allow for reprecipitation. All reprecipitation was of gold.

A second series of experiments was made in which it was attempted to keep the solution at: (1) One pound lime per ton solution. (2) One and one-half pounds lime per ton solution. (3) Two and two-tenths pounds lime per ton solution. (4) A saturated solution. This result was not obtained, although a large excess of lime was added. In all these later experiments the cyanide consumption remained about the same and the total extraction increased with the greater protective alkalinity.

Many apparent contradictions in the above will be found, for instance in the statement that the total extraction increased on using more lime while the highest results shown are after 24-hr. agitation with 1½ lb. lime (see tests 5 and 6), but in this case only the total extraction after 36-hr. agitation was considered.

Also comparing the first and second series the question naturally arises whether reprecipitation was due to lack of protective alkalinity, or excessive aëration, or both. Also it is possible in some instances that this apparent reprecipitation might be due to error in sampling or assaying. With this ore probably only 24 to 30 hours' agitation is necessary and a series of tests, taking samples at 6-hr. intervals, might show much better comparative results.

At this plant the most efficient protective alkalinity seems to be about 2 lb. CaO per ton, and our solutions titrate between 1.8 lb. and 2.2 lb. Lime consumption here is very high, varying from 13 lb. to 17 lb. per ton of ore treated.

It has been claimed by some that a high alkalinity is liable to cause a slight falling off in the gold extraction, but the results on this particular ore do not bear out the claim.

### Effect of Lime on Zinc Consumption

Another point which may be of interest is the effect of protective alkalinity on precipitation and zinc consumption. A weak solution (0.006% KCN to 0.012%

KCN) cannot be successfully precipitated, even though the zinc shavings have been dipped in lead acetate, unless the protective alkalinity exceeds 0.4 lb. CaO per ton, and generally the best results are obtained when the lime in solution is carried somewhere between 0.6 and 0.8 lb. per ton. Very high protective alkalinity causes an excessive consumption of zinc and also is liable to cause such violent action in the boxes that the danger of mechanical loss, with a heavy flow, is increased.

Unless a large excess of lime is used, it would seem that there is little probability of lime being lost on account of not having gone into solution, especially in an all-slime plant where from 70% to 85% of the ore ground will pass a 200-mesh screen, and the total time of contact from ore bin to filter press tails is from 48 to 96 hr. However, there does seem to be a chance for a fairly large loss of lime where air agitation is used, as we have found that a 24-hr. air agitation of solution alone caused a drop in lime from 2.26 lb. to 1.20 lb., while mechanical agitation caused a drop from 2.26 lb. to 1.88 pounds.

TABLE SHOWING EFFEGT OF VARIOUS AMOUNTS OF LIME ON EXTRACTION AND CYANIDE CONSUMPTION

| Test No. | Agitation Hr. | Lime per ton lb. | KCN % | Per Cent Extraction Au | Ag | Total | KCN Consumed per ton ore lb. | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1.04 | 0.060 | ..... | ..... | ..... | .... | |
| | 12 | 0.24 | 0.054 | 77.96 | 66.67 | 75.94 | .... | |
| | 24 | 0.01 | 0.045 | 89.83 | 73.33 | 86.87 | .... | |
| | 36 | 0.00 | 0.036 | 88.62 | 73.33 | 85.88 | 3.74 | No lime added. |
| 2 | 0 | 1.50 | 0.060 | ..... | ..... | ..... | .... | |
| | 12 | 0.59 | 0.054 | 89.17 | 73.33 | 86.45 | .... | |
| | 24 | 0.18 | 0.052 | 92.16 | 73.33 | 88.93 | .... | |
| | 36 | 0.00 | 0.040 | 91.47 | 73.33 | 88.36 | 2.20 | No lime added. |
| 3 | 0 | 1.98 | 0.060 | ..... | ..... | ..... | .... | |
| | 12 | 0.89 | 0.052 | 90.11 | 73.33 | 87.44 | .... | |
| | 24 | 0.35 | 0.052 | 92.21 | 73.33 | 89.20 | .... | |
| | 36 | 0.00 | 0.042 | 91.79 | 73.33 | 88.85 | 1.98 | No lime added. |
| 4 | 0 | 2.50 | 0.058 | ..... | ..... | ..... | .... | |
| | 12 | 1.25 | 0.052 | 89.47 | 66.67 | 85.43 | .... | |
| | 24 | 0.45 | 0.052 | 89.95 | 73.33 | 87.01 | .... | |
| | 36 | 0.00 | 0.042 | 91.15 | 73.33 | 87.99 | 1.76 | No lime added. |
| 5 | 0 | 0.98 | 0.058 | ..... | ..... | ..... | .... | |
| | 12 | 0.93 | 0.049 | 91.46 | 68.18 | 88.68 | .... | |
| | 24 | 0.71 | 0.048 | 94.65 | 77.27 | 92.57 | .... | |
| | 36 | 0.99 | 0.048 | 91.46 | 75.00 | 89.49 | 1.10 | Lime added. |
| 6 | 0 | 1.58 | 0.061 | ..... | ..... | ..... | .... | |
| | 12 | 1.34 | 0.050 | 91.22 | 70.45 | 88.80 | .... | |
| | 24 | 1.33 | 0.050 | 94.81 | 77.27 | 92.77 | .... | |
| | 36 | 1.50 | 0.049 | 92.02 | 75.00 | 90.04 | 1.32 | Lime added. |
| 7 | 0 | 2.26 | 0.058 | ..... | ..... | ..... | .... | |
| | 12 | 2.20 | 0.050 | 89.54 | 68.18 | 86.78 | .... | |
| | 24 | 2.20 | 0.049 | 91.90 | 72.73 | 89.42 | .... | |
| | 36 | 2.17 | 0.048 | 92.80 | 77.27 | 90.79 | 1.10 | Lime added. |
| 8 | 0 | 2.26 | 0.058 | ..... | ..... | ..... | .... | |
| | 12 | 2.26 | 0.050 | 89.54 | 68.18 | 86.78 | .... | |
| | 24 | 2.24 | 0.048 | 87.29 | 68.18 | 84.82 | .... | |
| | 36 | 2.10 | 0.048 | 93.59 | 75.00 | 91.19 | 1.10 | Intended to have been saturated. |

### Amount of Lime Should be Determined by the Metallurgist

From experience at this plant it does not seem that it is necessary to exercise anything like as much care in the addition of lime as that employed in adding zinc dust, but the quantity of lime used should be determined always by the metallurgist or cyanide superintendent as the practice has been discontinued, and lime is now added to the ore before going to the batteries.

One advantage in using lime in the form of an emulsion is, that unburned lime and other admixtures which the poorer grades of lime may contain are kept out of the plant. However, as the total amount of lime added to an ore rarely exceeds 1%, this is of minor importance.

Tantalum is used for making pens, surgical instruments, electrodes in X-ray tubes, and the filaments of incandescent lamps.

[1]Eng. and Min. Journ., May 4, 1912, p. 869.

## Rhodesia Mining Notes

Johannesburg Correspondence

Is a mine like the Lonely over or under valued? It is valued in the market at about £1,000,000. It is working a quartz vein having a shoot of ore about 1000 ft. in length and the reef has been cut at the eighth level or at a depth of about 900 ft. The ore developed, practically all above the seventh level, is estimated at 148,738 tons over a stoping width of about 48 in., assaying 23 dwt. per ton, and the profit in sight was calculated to be £484,458 on Mar. 31, 1912. The plant was to be capable of milling 4000 tons per month, but owing to transport difficulties and the necessity of adding another tube mill to crush the ore finer than was anticipated, it has not yet reached that figure. Last year the profit was £38,336. The vein is a regular one in serpentine schist and except for enriched ore at the outcrop, the lowest level shows the best grade and widths of ore. The vein averages on this level 45½ in. wide with a value of 37s. Working costs are about 25s. per ton.

The ore reserves in the Giant mine are rapidly decreasing and the end of the life of the mine is in sight if another orebody is not discovered. On Mar. 31, 236,837 tons remained and the mine is crushing 11,000 tons per month, the yield being £1 12s. 1d., and profit 18s. 3d. per ton.

The Rezende mine is working a large low-grade quartz reef at Umtali, from which some argentiferous galena is also concentrated. The net profit for 1911 was £13,119, the yield 27s. 2d. per ton, and working cost 21s. 4.7d. The ore reserves include 102,248 tons valued at 7 dwt. and about 40,000 tons of low-grade ore worked by tributors. A mill of 56 Nissen stamps is ordered for the Shamva mine, to reduce 50,000 tons per month.

## Midwest Oil Co., Casper, Wyo.

Special Correspondence

Though little is heard of it, extraordinary activity and production is reported as going on in the oil district of Casper, Wyo. The Midwest Oil Co., operating four flowing wells and having 40 others which are down to the oil sands, together with a refinery at Casper, has announced a dividend of 2% on the $2,000,000 preferred stock of the company. This is the first dividend and is the result of six-months' operation. Earnings at the present rate of production are equivalent to 13% on the preferred and 7% on the $5,000,000 of common stock. There is said to be in storage enough crude oil to keep the refinery going for 100 days and the plant is being increased to a capacity of 8000 bbl. per day.

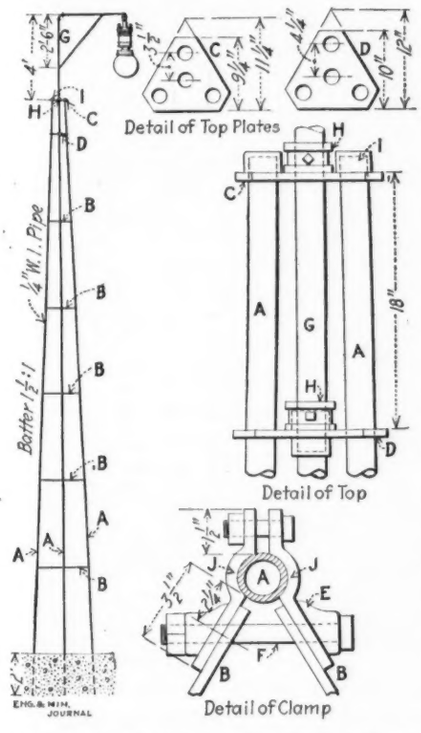
# Details of Practical Mining

**Accounts of Useful Ways of Doing Many Things in the Day's Work**

## An Arc Light Tower

The details of construction of an arc-light tower, made chiefly of pipe, and used at the mines of the St. Louis Smelting & Refining Co., in Southeastern Missouri, are shown in the accompanying drawings. These towers are used to support the arc lights that illuminate the yards in the immediate vicinity of the main shafts and shops.

The legs *A* of the towers are pieces of 1¼-in. pipe set in concrete pedestals




ARC-LIGHT TOWER FOR SURFACE USE AT MINES

at a batter of ½in. per ft. The three pipes are tied together at intervals of 4 ft. by cross braces *B*, that are made of pieces of ⅜x1¼-in. steel cut to the proper length, and by bolting to the standard clamps *C*, that are made of pieces of the same size of steel bent to the shape shown in the accompanying detailed drawing of the clamp and held together by bolts; 30° malleable-iron angle washers *E* being used on the coupling bolt *F*. At the top there are two triangular plates *C* and *D*, that slip over the legs. These are made so as to ride the legs about 18 in. apart. Caps *I* are screwed on the top of the legs after the plate has been put on. In the center of these plates a hole is bored to receive the pipe *G*, also made of two pieces of 1¼-in. pipe put together with an elbow and reinforced by an angle brace of ⅜x1¼-in. steel. On this top piece that carries the arc light are two collars *H*, that rest upon the two triangular plates. Owing to the way that the three legs are strapped together, all the fittings are standard and the cost of the towers is small.

## City Deep Winding Engine

JOHANNESBURG CORRESPONDENCE

A new type of electric winding engine has been installed at the No. 2 shaft, of the City Deep mine for hoisting men and material. It has two cylindrical drums 11-ft. diameter, 4-ft. face, one being loose on shaft and controlled by a jaw clutch and the other fast. The drums are on the same shaft as a three-phase induction motor of 1600 boiler hp. controlled by the Eddy current brake. There are only two main bearings for drums and motor. The hoist can raise a net unbalanced load of 5 tons at a speed of 3500 ft. per min. from a depth of 3250 ft. at 100 r.p.m. of the motor. The hoisting rope is 1½ in. and a tail rope is attached. The motor takes current at 2000 volts, 50 periods, and is controlled through a three-phase water resistance in the motor circuit. Both drums are fitted with brakes operated by compressed air. The Eddy current brake consists of a revolving direct-current field-magnet system constructed like an alternator, having a hollow cast-iron stator turned true to reduce the air gap, and being hollow and water cooled.

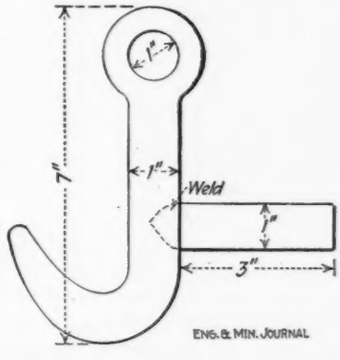
Eddy currents are generated in the stator varying in strength with the direct current exciting the magnets and the braking is so powerful that the hoist can be lowered at any speed without using the post brakes. A generator for exciting the magnets is driven by a three-phase motor to supply current and a storage battery is held in reserve. There is a similar winder at the Turf Mines shaft 3000 ft. deep. The British Westinghouse company supplied the electrical portions of the hoisting apparatus.

**In an assay office using an ordinary pot-fusion and muffle-cupel furnace, it required about four gallons of oil composed of four parts crude oil to one part engine distillate; fed under a 30-lb. air pressure to run 50 assays.**

## A Bucket Dump-Hook

In the Joplin district practically all the ore is hoisted in buckets. The hoisting engine is set in a four-post derrick frame next to the well of the shaft, and the hoistman hooks the tail, or dumping, rope into the ring in the bottom of the bucket, and slacking off on his friction brake, dumps the bucket. In order to allow the hoistman to grab this hook and at the same time to swing over the door that closes the shaft, this bucket hook is made with a handle sticking out behind. This handle should start out from the shank of the hook about level with the tip. This makes the missing of a ring less likely to occur as the hooking is then a punching action directed so as just to miss the ring in the bucket.

The advantage of the handle, no matter where it is put, is that the point of the hook is always at a constant distance above the hand, and as all the fingers hold the handle and none is used around the shank of the hook there is no danger of mashing the hand. Consequently, the hoistman can hook with no other thought




DUMP HOOK USED IN JOPLIN DISTRICT

than properly placing the point of the hook in regard to the ring. This may seem to be a small item, but really it is largely through this handle on the dump-rope hook that the remarkable speed in Joplin hoisting is obtained. When a man hoists and hooks 1031 buckets in 7½ hr. from a depth of about 250 ft., the design of the hook is of importance. It is no uncommon thing for 900 buckets to be raised in 7½ hr., and usually about 500 buckets are raised. Often a round trip is made from a depth of 250 ft., measured from the floor of the derrick, in less than 30 sec., including the time of hooking and unhooking the bucket underground and dumping at surface.

## Headframe with Guy Rope Bracing

The headframe at the No. 4 shaft of the St. Louis Smelting & Refining Co. in southeastern Missouri, is approximately 70 ft. high, and no bracing legs are used in the construction. The frame is surrounded by the shaft house with a landing platform for pulling off the cars at the level of the top of the bins, which are about 30 ft. high, but this shaft house and bin do not aid in steadying the structure. The bracing is obtained by four ⅞-in. guy ropes that are anchored to concrete deadmen. The guy ropes are tightened by turnbuckles or else by pulling the rope back on itself after passing around a small sheave anchored to the deadman. This wheel is large enough to permit the rope to be pulled around it without injury, by a block and fall fastened to the end of the rope and attached to the rope itself. This is the best way of tightening the guy rope.

When turnbuckles are used they may be put in the main guy lines, but this gives less binding together and less strengthening against vibration than when an auxiliary rope or even two ropes are brought over from each of the main guy ropes and fastened to the steel work of the headframe. Then by means of turnbuckles and these binding ropes the whole guy line can be pulled together as tightly as desired. In case the sheave is used the auxiliary guy ropes are put on first and the whole tightened by pulling with the block and tackle on the main guy rope. Turnbuckles can also be added to these auxiliary ropes in the sheave system.

The ore is hoisted on one-deck cages in 1-ton cars, and little trouble is experienced from vibration of the headframe. There are several of these headframes in the district in which no back legs are used, but in which the bracing is done entirely by guy ropes. Little trouble from vibration is experienced as the guy ropes are always maintained taut.

## Joplin Ore Buckets

In the Joplin district of Missouri practically all the ore is hoisted in buckets. These buckets, or cans or tubs, as they are commonly called, are made with straight sides. The ears are welded to straps instead of being riveted to the sides. The buckets are used without a crosshead to guide them through the shaft, and so have to stand much rough usage.

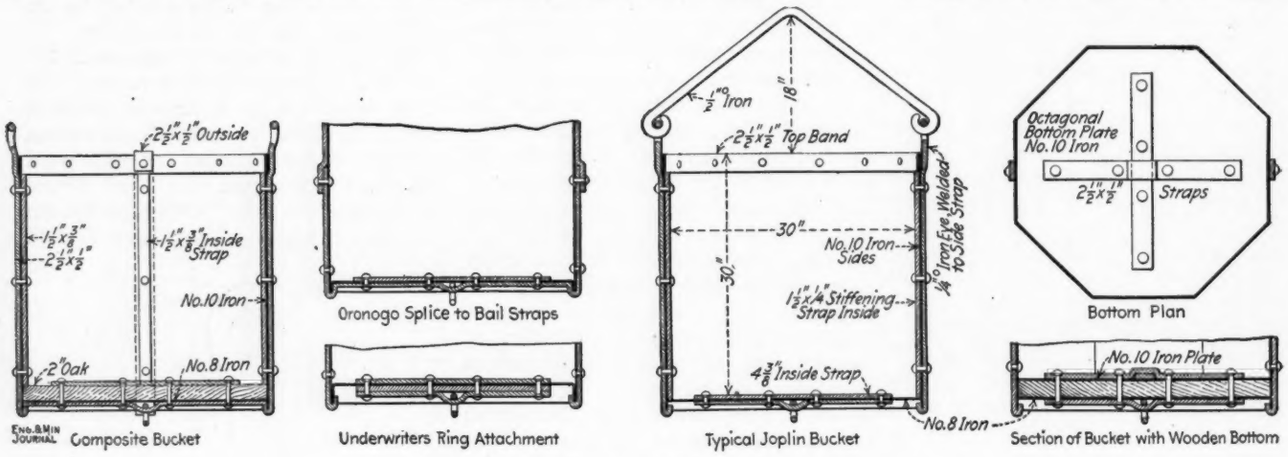
They are made with a bottom flange about 1½ in. deep so that the buckets will rest flat upon the tub cars. On the bottom there is a cross strap riveted to another strap inside. This distributes the strain of the pull from the bottom ring while dumping the bucket at surface by a tail or dump rope fastened to the derrick frame. The side straps also are riveted to stiffening straps on the inside, while the ears are of 1¼-in. Norway iron welded to the 2½x½-in. side straps. The bail is of 1½-in. Norway iron of V-shape with a slight curve at the apex for the reception of the hook. This bail is made with the hooks turned in so as to be less liable to catch on timbers during hoisting.

Characteristically the side straps come down and turn up so as to hook over the flange at the bottom, thus throwing the weight of part of the load on the hook as well as on the three rivets by which the side straps are attached to the bucket. But in the case of the buckets at the Oronogo Circle mine the side straps end on the sides where they overlap and are riveted through the bottom strap which runs up the sides for about a foot as is shown in the accompanying drawing. In this way the strain of dumping is taken from the bottom, which already takes the most of the wear and tear of usage, and is thrown on the sides. But a slight drawback is that by this arrangement the whole weight of the load is thrown on the three rivets of the side straps. At the Underwriters mine, commonly called the Yellow Dog and better known by that name, an extra piece of iron is put in under the bottom strap, as shown in the drawing, to keep the ring from punching a hole through the bottom of the bucket.

In the case of the majority of the buckets used in the Joplin district the bottom is only a sheet of No. 8 iron. To protect this from wear the shovelers are made to throw in fine dirt at first, and then after a protecting layer has been formed on the bottom, the boulders are loaded. In the case of the Federated Zinc Co. and a few others, tubs with wooden bottoms are used. This wooden bottom of 2-in. oak is protected from the cutting of the boulders by a plate of No. 10 iron, and seems to be serviceable.

The flange at the bottom of the bucket becomes battered in the course of time. In one instance instead of flanging the bottom plate, buckets were made with an angle-iron ring riveted to the sides at the bottom. The bottom plate then rested on this angle, but such buckets are much more expensive to make than are those of the flange type.

Owing to the fact that the hoisting is done without a crosshead, the buckets often catch on the cribbing timbers. On that account the top of the bucket is reinforced by a band of 2½x½-in. iron. A few buckets are built with side stiffeners put in half way between the side straps. These run vertically from top to bottom of the bucket and are turned over to form a hook over the top band as well as at the bottom flange. As these extra side straps are riveted to the top band there is less danger of the bucket being bent out of shape when it catches on the timbers in the shaft. But the main advantage is that the bucket, in landing on the plat at the bottom of the shaft strikes on these side straps; consequently the flange is less liable to be bent. In many instances, the bottom strap is extended clear across the bottom and caught in under the turn-up of the ear straps. This seems to be the best way of putting on the bottom strap as in this way part of the strain is thrown on the side straps




TYPES OF ORE BUCKETS USED IN JOPLIN MINES

while the bucket is being dumped and taken off the bottom plat, but it is not commonly done as the bucket is slightly harder to make that way than the other.

Probably the best bucket is obtained by toeing the bottom strap under the hook of the ear straps, using a wooden bottom, and putting in the extra side straps already mentioned. But there is the drawback that this makes the bucket somewhat heavier and more awkward for the hooker to handle when he changes buckets at the bottom of the shaft. Moreover, they are somewhat more costly in upkeep. In case that a wooden bottom is not used, it is well to put in the extra strap so as to protect the bottom from wear by the ring. Such a bucket combining the good points in several of the "tubs" in use in the Joplin district is shown in an accompanying sketch.

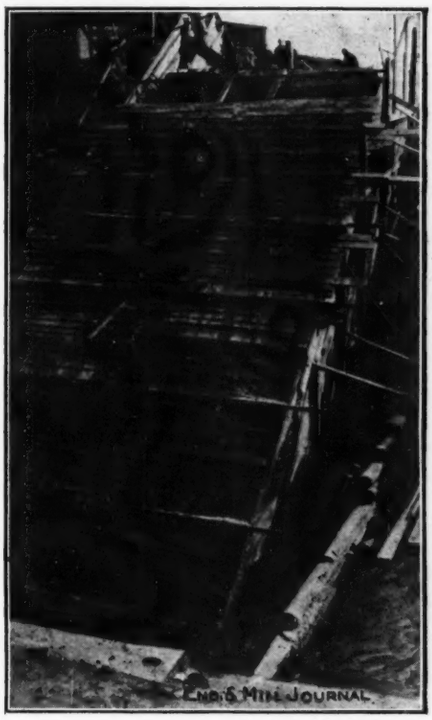
These tubs or buckets are made in certain standard sizes. The largest buckets used in the Joplin district are those at the Davey mines of the American Zinc, Lead & Smelting Co. These are 34 in. in diameter and 34 in. high. They hold as loaded about 1200 lb., but at the rating placed on buckets in the district these large buckets would be called 1600-lb. cans. The most commonly used sizes are the 30x30-in. buckets, with 30-28-in. and the 28x30-in. buckets close seconds, the diameter being given first in all cases. These are called 1200-lb., large 1000-lb. and small 1000-lb. cans, respectively. Other sizes used in the district are 26x28-in. tubs called 850-lb. cans, 24x28-in. buckets rated at 750-lb. and 22x26-in. tubs rated at 500-lb. capacity. These last three buckets are used at the silicate and the lead gouges rather than at the zinc and silicate mines. In some instances 28x32-in. and 30x32-in. as well as 32x34-in. tubs have been used.

None of these buckets hold what they are rated at, for they are rarely filled more than four-fifths full. In mining the ore breaks in many boulders, especially in the case of the stope holes, so that there is much empty space in the buckets. Indeed, it is necessary to keep a close watch upon the shovelers to prevent them from building "windies," as they are called in the district, by piling the boulders into the tubs in such a manner as to leave a large percentage of the tub unfilled. The larger the diameter of the bucket, the more difficult is it to build these "windies" so that it is better to use either a 30x30-in. or a 30x28-in. than a 28x30-in. bucket, especially when mining the deposit by a "stope." The real amount that these different buckets hold depends upon the richness of the ore for upon that, to a large extent, depends the fineness to which the ore breaks, as well as upon whether the ore comes from a stope or a heading. The 30x30-in. cans which are rated at 1000-lb. capacity throughout the district have been found, in many instances when their contents was weighed, to hold about 850 lb. on an average when loaded with dirt broken fine from a heading, while the buckets that were loaded from the stope piles only weighed 800 lb. Many of the operators in the district make such allowances in calculating their yield and their costs, but some use the rated capacities.

## Concrete Collars for Mine Shafts

Inclines at mines in the copper country are now commonly equipped with a concrete shaft collar so as to keep the surface water from coming in. Moreover such collars prevent possibility of fires extending underground. Generally the shafts have to be sunk through a considerable depth of overburden, and often this is a sort of quicksand. The general procedure is to strip a large enough area of overburden to open a pit in which the sides stand at the angle of repose of the material without interfering with the putting in of the shaft collar. The concrete collar is started from a bench cut down to solid rock so as to permit making a water-tight joint between the rock and the collar. After the collar has been finished, the ground is piled in again to fill the excavation.

At the Mohawk No. 6 shaft, where the collar was 99 ft. long and had outside dimensions of 22x11 ft. with walls 12 in. thick, the burden was 45 ft. deep. The accompanying halftones show the manner of putting in the collar, with the forms in place, and the troughs, down which the concrete was poured from a mixer at the top. In order to keep the concrete from separating as it went down the troughs splash boards were put in every few feet to retard the descent, while at the bottom the concrete was caught on a platform, turned over with a shovel and then shoveled in to the



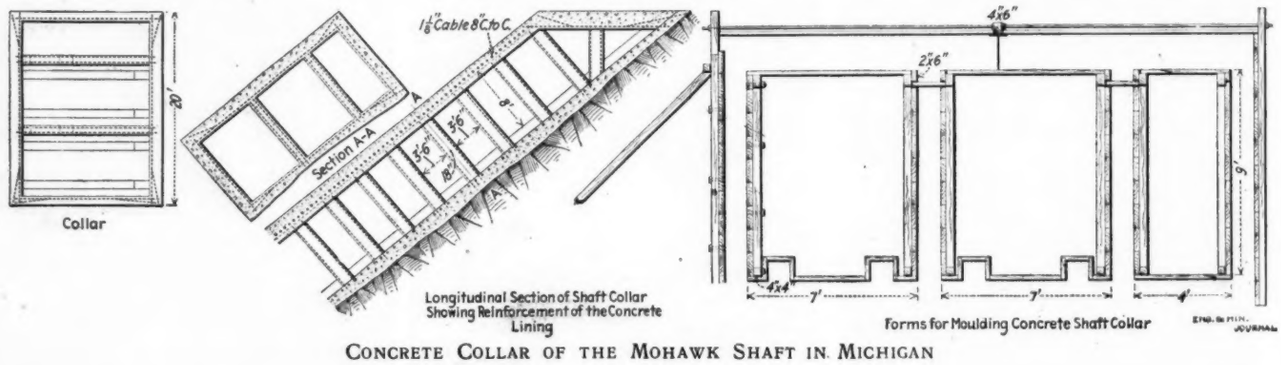

FORMS USED IN CONCRETING THE MOHAWK NO. 6 SHAFT

STARTING THE CONCRETE COLLAR FROM LEVEL OF SOLID GROUND

FORMS NEAR SURFACE SHOWING METHOD OF DELIVERING CONCRETE

forms. As the work progressed upward, the platform was also raised. No trouble was experienced by the mixed concrete separating and the turning over was done as a precaution more than as a necessity, while the sliding of the concrete down from the mixer, placed where the materials were near at hand, made the cost much less than it would otherwise have been. This was the first time that an attempt had been made in the copper country to slide concrete down troughs to the forms. A 1:3:5 mixture was used, the rubble being rock from the mine, crushed to pass a 2-in. screen with the fines left in.

Another feature of the erection of this concrete collar was the use of knock-down forms made in the carpentry and used over and over again as the collar progressed upward. This was the first time that practice had been attempted in the copper country, but it proved to be satisfactory and enabled making a considerable saving in the cost of erecting the forms, which is one of the main expenses in putting in concrete collars. An accompanying drawing shows the manner of building the knock-down forms, and the way that they were held in place by braces and bolts on the inside as well as on the outside, while the accompanying halftones give a still better idea of the manner of putting in the forms, when studied in connection with the detailed drawing.




CONCRETE COLLAR OF THE MOHAWK SHAFT IN MICHIGAN

In reinforcing the collar at the Mohawk shaft, main dependence in strengthening the concrete against tensile and shearing stresses was put on pieces of old hoisting cables. These were cut from discarded 1⅛-in. hoisting cable that had been cleaned by going over its surface with wire brushes to remove the rope "dope" on the surface, while the dope which was imbedded between the strands was scraped out with an iron hook.

Burning of the rope dope was out of the question as enough heat would have been generated to take the temper out of the wires so that the rope would then have stretched and become useless as reinforcement. In fact, the main recommendation of old hoisting cables for reinforcement is, that by service in the shafts practically all the stretch has been taken out. This hoisting cable was laid off in the proper lengths with pieces of string as markers, and cut by passing it under a steam hammer that struck the cutting tool when held at the proper place. This was found to be a cheap and rapid way of doing the cutting, for practically all blacksmith shops in the copper country are equipped with a steam hammer. This rope was put in to form the cross rods for strengthening the bottom, top and sides of the collar, and each alternate rope was turned up at the ends at an angle of 45°. In this way the shearing stresses near the ends were taken care of in a cheap but effective manner, for it would have been too expensive to try to take care of them in these collars by stirrup pieces as would be done in a good beam properly reinforced.

In figuring the reinforcement the rope was assumed to have half the strength of an iron bar of the same area, and the area of the rope reinforcement at the bottom of the collar was kept at about 2% of the sectional area of the walls so as to be sure that there would be ample reinforcement. Consequently, these ropes were spaced at intervals of six inches in the lower part, but as the weight of the burden decreased the space was increased until near the top of the collar the rope pieces were about 10 in. apart. These ropes were placed in the forms so that they would be about an inch from the inside surface of the walls; approximately one-tenth the depth of the wall.

The divider columns, which were carried along both between the tracks and the tracks and the manway, in order to brace the top, were 12x18 in. in section and were reinforced by four ¾-in. bars wound with ¼-in. rods to hold them in position with respect to one another and to aid the post in resisting bending stresses. These bars ran down a little beyond the bottom of the collar to aid in anchoring it to the overburden. The rods for strengthening the dividers were fastened to two pieces of hoisting cable that ran down along each line of divider columns to reinforce the beam, six inches deep, that was carried along between the dividers to bring the top weight between the columns back on them.

Poultry netting was put in, not as reinforcement, but as centering to hold the pieces of rope in their proper relation to one another and to the forms. To this heavy poultry netting the rope was wired. After this poultry netting carrying the ropes had been nailed to the inside forms so as to secure the reinforcement in its proper place with respect to the finished structure, the outside forms were erected around it, and the concrete, shot down by chutes from the mixer to the platform, was shoveled in. Then the planks of the top form were nailed on as fast as the forms were filled with concrete. After about four forms has been filled, and the concrete in the bottom form had set about a day and a half, the outside forms of the bottom section were removed by loosening the top bolt and knocking out the side braces, while the inside forms for the walls and the columns were also taken off. The forms were then re-erected and used again.

In fact, the whole 99 ft. of collar was completed 19 days after the beginning of concrete work. In its construction 9000 ft. of 1⅛-in. hoisting cable weighing nine tons was used together with 176 rods ¾-in. diameter and 11 ft. long, weighing about 1½ tons; 888 ft. of ¼-in. rod weighing 147 lb., 4500 sq.ft. of heavy poultry netting; 16, 45-lb. rails; two 60-lb. rails and 12,000 bd. ft. of pine. This lumber was used for forms while the rails were used in reinforcing the bottom of the collar where it was seated on the ground.

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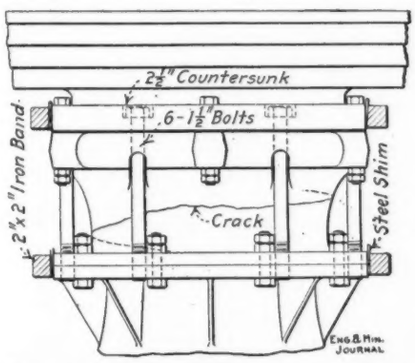
At a recent meeting of the Institution of Mining and Metallurgy, W. H. Trewartha-James stated that in reaming out a certain borehole, rods had to be used that were much smaller than the reamed hole. This caused considerable vibration in the rods, which was corrected by using collars on all the rods. These collars offset any tendency of the rods to bend at the middle.

# Details of Metallurgical Practice

**Records of Experience in Ore Dressing, Cyaniding and Smelting**

## Repairing a Gyratory Crusher

At the Leadwood mine, of the St. Joseph Lead Co., some trouble has been experienced by the breaking of the top shell of No. 4 style B, and K Gates gyratory crushers that are used for crushing coarse ore. The shells of two No. 4K and of one No. 4B crushers have been repaired. The trouble seems to have arisen from the fact that the shell between the two rings is not reinforced by ribs. As these parts cost about $269 new, an economy was effected by repairing them as it only cost about $30 to $40 to fix one of the cracked shells. One of the top shells that has been fixed in the manner to be described, has been in use for four years and gives no sign of failing, while another has been in use for two years. The third has just been




REPAIRING CRACKED SHELL OF A GYRATORY CRUSHER

repaired and has not yet been put in service again.

A crack running around the shell and almost cutting the top off the bottom part before the crack runs down into a flange, seems to be the characteristic way for a shell to fail. The sketch illustrates this. The two parts have to be bolted together, and to insure the bolts not breaking out of the flanges, bands have to be shrunk on the shell at the flanges. These hoops or bands are made by welding together bars of 2x2-in. iron, while six 1½-in. bolts are used to tie the top and bottom pieces together.

The reinforcing bands are made as nearly round as possible and are welded so as to make a tight fit on the shell. They are put around the flanges and any places where they do not quite touch are filled in with thin shims or wedges of steel. To shrink on a band a ring of firebrick is built around the shell, then a 1½-in. pipe with holes bored in it is put around between the bricks and the shell, and is connected with the compressed-air supply pipe. Coke is piled on top of some kindlings; the fire is started; and the air turned on this improvised forge. In this way the reinforcing bands are heated. While the bands are hot the wedges are driven in as tight as can be. Upon allowing the shell and bands to cool, the reinforcement shrinks tightly on the flanges so that there is no possibility of breakage by the strain from the bolts that are later put in.

Holes are bored in the flanges for 1½-in. bolts. The holes for the top flange are countersunk so as to receive the heads of these bolts, as the hopper has to be set on top of the top flange, while the holes in the bottom flange are tapped so as to catch the thread of the reinforcing bolts. Then with Stilson wrenches, the six bolts are tightened as much as they can be, while held at a place between flanges to prevent turning. In this way the shell is bound tightly together and is made almost as strong as it was when new.

## The Diaphragm Cone Classifier

The Caldecott diaphragm, cone classifier illustrated in the accompanying sketch, was introduced into South African ore-treatment practice in 1908. It differs from other types of hydraulic classifiers in that it must be operated while filled or partly filled with settled solids, instead of with the usual fluid pulp carrying ore particles in suspension and rapid movement. The diaphragm is a support for the settled solids, and is placed near the bottom of the cone at a little distance from the sides so that the solids may gradually pass down the annular space around the periphery of the diaphragm to the outlet at the apex of the cone. As a rule the diaphragm consists of a plain disk of wood or thin sheet steel, conveniently supported as shown in the illustrations. Conical, perforated, and curved forms have been proposed, but in practice these show no special advantage. The simplicity and cheapness of the device renders an adjustable form hardly necessary, since a few trials with wooden disks will speedily result in the most suitable diameter and position being ascertained for any existing set of conditions.

In general it may be said that the coarser and more granular the pulp fed to a diaphragm cone, the greater its capacity, but with a fine pulp containing much colloidal slime its capacity is less, and owing to the tendency of the settled solids to cohere and bridge over the annular space at all except one point, this space must be made wider by placing the diaphragm higher in the cone. Unless this is done, the function of the diaphragm in preventing a single vertical channel from forming in the mass of settled solids down which the pulp descends, cannot be performed and its efficiency is in consequence impaired.

The diaphragm cone is largely used in South Africa for separating coarse sand from the pulp for crushing in tube mills. The standard cone for this purpose on the Rand, for a 5½x22-ft. tube mill is 6 ft. in diameter by 9 ft. deep with a flat disk diaphragm 8 in. diameter, and so placed in the cone as to have an annular space around it 2½ in. wide or more, according to the more or less slimy nature of the crushed ore.

The circular outlet at the apex of the cone, in the shape of a replaceable cast-iron nozzle, is 1½ to 2¼ in. in diameter, and yields an underflow of 200 tons to 400 tons of solids per 24 hours, as a pulp containing about 27% moisture. A cut-off gate, shown in the accompanying illustration, is used to regulate the underflow to any further degree required, or to stop it entirely. Owing to its viscous nature, the underflow must be allowed to fall freely from the cone, as any attempt to change its direction by means of a curved pipe from the outlet merely results in choking. This thick underflow issues at a slow velocity, and when large tonnages are fed to the tube mill, is usually diluted with water or solution, before entering the tube mill, to a pulp containing about 40% moisture. The slow velocity of the underflow is the reason why so large an outlet can be used, and this practically obviates any risk of choking by chips of ore or accidental refuse to which ordinary classifiers with fluid underflow and small outlets are liable.

Smaller cones can of course be used, but a sufficient superficial settling area is always desirable to allow all particles requiring regrinding to settle, as otherwise return sand, safety cones for the overflow pulp are necessary. In most cases on the Rand the tailing pulp overflowing from the classifiers must be de-

livered at a considerable height for subsequent cyaniding, so that there is usually ample fall available for the installation of cones of any desired dimension. The use of a large cone is not detrimental from the classification standpoint, as the settled solids form a basin of greater or less diameter, according to the volume of inflowing pulp, which serves as an automatic regulator and insures a uniform and constant underflow. If a coarser pulp than usual is delivered to the classifier, the coarseness of the underflow and overflow is correspondingly increased, and the tonnage of the former is also increased, while its moisture is slightly decreased. A diaphragm cone, run so full of settled solids that the outflowing pulp stream near the periphery is hardly ¼ in. deep, is practically a center-discharging buddle, with the consequent efficacy of that well known metallurgical appliance for retaining pyrite for further comminution.

The following grading analysis illustrates the nature of the classification effected by the cone for separating sand for return to tube mills, the underflow of the cones entering the tube mills and the overflow passing to the cyanide plant.

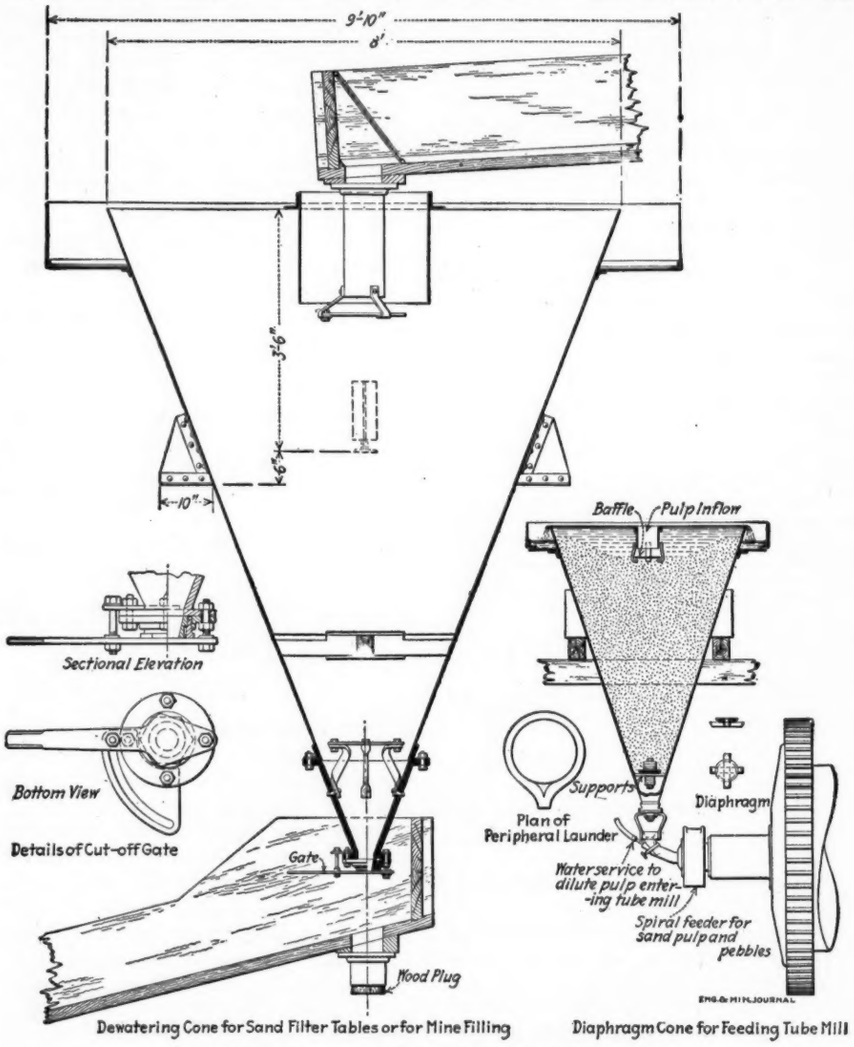
| | +60 | −60+90 | −90 |
|---|---|---|---|
| Underflow ..... | 67.1% | 20.7% | 12.2% |
| Overflow ..... | 7.4% | 15.9% | 76.7% |

Large cones, 8 ft. diameter by 10 ft. deep are used on the Rand to separate the leachable from the unleachable sand in the pulp, the sand going to the Caldecott sand filter tables for further dewatering the thick sandy underflow. The diaphragm cone was indeed originally devised as an accessory to these filters to insure their receiving a large steady volume of sandy pulp containing a minimum of slime and moisture. The following table shows the grading analysis of the pulp which was classified into about equal tonnages of sand and slime while treating a very large amount of crushed ore per day.

| Screen | Sand, Per cent. | Slime, Per cent. |
|---|---|---|
| + 60 | 8.4 | ..... |
| + 90 | 33.3 | ..... |
| + 200 | 46.3 | 2.21 |
| — 200 | 12.0 | 97.79 |
| | 100.0 | 100.00 |

While the operation of these large cones is the same in principle as the tube-mill cones, the fine-slime overflow renders larger cones necessary to settle all the sand, and the underflow of sand pulp contains about 30% moisture. Two diaphragms will be observed in the figure, the upper being to reduce the tendency of the settled solids to pack, while the under supports of the lower diaphragm afford a clear annular space for settling and reduce the tendency, if much colloidal slime is present, for the settled sand to be cemented together and bridge over this space at all except at one point, thus destroying the efficacy of the diaphragm. The efficiency of the diaphragm for affording an underflow almost free from slime is due to the small amount of moisture present, to which suspended slime is proportional, since with a tailing pulp of 7 of water to 1 of solids and containing 60% sand, 96% of the total water passes away with the slime in the overflow, while the underflow contains 30% moisture or little more than the water in the interstitial spaces of the settled sand. By varying the number of these cones and by diluting or not the underflow with water before entering similar cones so as to wash out more very fine particles, the percentages of sand and slime separated can be varied within wide limits.

These large cones are also extensively used for dewatering cyanide-plant tailing before pumping or gravitating through a borehole into a mine for filling purposes. The surplus water in the pulp enters the diaphragm cones, overflows and is returned in circuit to the pump to serve for bringing up more sand. This system has been in satisfactory use during the last year at the Simmer & Jack mine.




APPLICATIONS OF THE CALDECOTT DIAPHRAGM CONE

## Keeping the Commutator Clean

When the commutator on a direct-current motor becomes dirty, relief may sometimes be had by wrapping one group of the brushes with a piece of thick felt, so that the brush tension will hold the felt firmly against the commutator surface, and leaving the felt in position with the motor in operation, says the *Electrical Review*, July 6, 1912. Canvas cloth may be used in place of felt. The cloth should be tied securely around the brushes. As soon as the commutator has acquired a bright, glazed surface, the cloth should be removed.

The cloth being an insulator, it may be impracticable to wrap all the brushes in one group, where the number of groups of brushes on a machine is small. In such a case, the desired results may usually be obtained by wrapping one brush in one group and another brush in another group not tracking with the first, and so on until the entire surface of the commutator is rubbed with the cloth while the armature is rotating.

# Notes from Current Literature

**Concerning Mining, Metallurgy and Industrial Chemistry**

## Gold Absorption by Retorts

The work of Murray and Stanley on the above subject has already been noted (ENG. AND MIN. JOURN., Mar. 9; Mar. 16, 1912). The same authors now make the following suggestions as to reducing this (*Journ.* Chem., Met. and Min. Soc. of So. Africa, May, 1912). If a sheet-metal liner, say, ⅛ in. thick, could be placed inside the cast-iron retort it would certainly absorb less gold than the cast iron would. White iron would absorb less than gray iron, because of the absence of graphite, although this difference would disappear in time. While suitable trays will prevent gold coming into contact with the retort, there is always likelihood of spilling over the side; of "spitting," from entrained water; of leakage through an accidental crack; or of transmission of gold by a thoroughly saturated tray. The two last evils can be somewhat alleviated by using stamped-metal trays instead of cast iron.

The authors also make a suggestion that absorption of rich lead by furnace bottoms can be prevented to some extent by dipping individual bricks into a wash of lime and borax, drying and refiring.

## Shipping Cement in Bulk

Shipping cement in bulk has been initiated by the Universal Portland Cement Co., (*Eng. News,* July 25, 1912). The company has issued the following statement:

Recently a carload of Universal left the mill at Buffington, Ind., consigned to Milwaukee. The experiment proved highly successful in every way. The car arrived at its destination with absolutely no signs of loss or damage. The cement was left smooth and undisturbed in apparently the same condition as when it left the mill. The car was unloaded with shovels into wheelbarrows and the operation seemed to cause less dust than does the handling of cement in sacks. Some of it was wheeled directly to the mixing plant of a block and sewer pipe factory and the rest of the cement was stored in a warehouse.

Dealers and cement users who have to team will probably continue to demand shipments in sacks, but factories making cement products and contractors doing big jobs adjacent to railroad tracks and using central mixing plants could probably be served better and more economically with bulk shipments of cement. The experiments may show that a large amount of capital is unnecessarily tied up in sacks, and if it is found that cement can make a trip from the mill to the job in bulk just as well as in sacks, a heavy item of expense will be eliminated.

Grain and other commodities having a much higher value per ton are shipped in box cars in bulk. It is believed that with a very small investment in unloading equipment and storage facilities, those who receive shipments of cement will find it a paying proposition to receive carloads in bulk.

## Pig Steel by Direct Smelting

The production of pig steel direct from the ore, in the electric furnace, is the subject of a paper by Dr. J. W. Richards before the Engineers' Society of Western Pennsylvania. Owing to the decreasing supply of charcoal, the Swedish iron makers have been forced to take up the electric furnace in order to decrease the carbon consumption. When running with the low carbon and low temperatures possible under such conditions a product was obtained carrying 97 to 98% Fe; 0.1% Si; 0.1% Mn; and as little as 0.5% C; that is, the product is a pig steel.

Under these conditions there is no carbon banked up in the furnace and the furnace runs fast, while there is so little impurity to remove that the openhearth furnace has its capacity increased at least 50%, so that the process is claimed to be of advantage in every way.

## Potash from Insoluble Silicates

The Bureau of Soils has recently been investigating the various methods proposed for the recovery of potash from various insoluble silicates, such as feldspar, mica, etc. (*Circ.* No. 71, U. S. Dept. of Agriculture). These methods are nearly all based on the decomposition of the silicates by lime or calcium chloride, or some similar reagent, and after extensive experimenting it is thought that to be a commercial success, the byproduct as well as the potash must be useful.

It was noted in calcination experiments at high temperatures that the alkalis were volatilized with comparative ease, so that the method is suggested of heating feldspar with lime or calcium chloride in such proportions as to produce a clinker which, after the alkalis are volatilized, will be of the proper composition for grinding into portland cement. For instance, one part of feldspar with 1.68 parts of CaO, will, on ignition, lose 0.17 parts of alkalis, and leave a clinker carrying 25.8% $SiO_2$; 7.3 $Al_2O_3$ and 66.9 CaO; while a portland-cement clinker will carry 19 to 26% $SiO_2$; 4 to 11 $Al_2O_3$; 58 to 67 CaO; 2 to 5 $Fe_2O_3$; up to 5 MgO; up to 2.5 $SO_4$; and up to 3 of alkalis.

## Elemental Character of Tellurium

It is interesting to note that William L. Dudley and E. V. Jones have again been working on the nature of tellurium (*Journ. Am. Chem. Soc.,* Aug., 1912). Suspicions as to the true character of this element have been raised by its atomic weight, 127.5, being higher than that of iodine, 126.92, whereas their relative positions in Mendeléeff's table would indicate the reverse. The authors found that fractional precipitation with hydrazine chloride gave purer tellurium than had before been obtained, and that spectrographic results on this purified metal are indicative of its being a true element, instead of a mixture of two elements, one of lower atomic weight than iodine, and the other higher than the present tellurium. Tellurium purified by the regular methods, although apparently pure by chemical methods, showed traces of copper, iron and silver.

The authors are, however, unwilling to accept their results as being conclusive except insofar as apparently negativing the existence of Mendeléeff's hypothetical dvitellurium (at. wt. 212), but say that the existence of two substances in tellurium (such as existed in didymium), differing but little in atomic weight and remarkably alike in other properties is possible, and that future research must be on the line of a possible fractionation of these two substances.

## Value of Sanitation

The value of preventive measures against disease is most strikingly shown by the results on the Adriatic lines of the Italian railways, says *Rivista Tecnica delle Ferrovie Italiane,* June, 1912. The campaign was started in 1899 immediately after the discovery of the part that the anopheles mosquito plays in malaria, and consists of drainage and petroleum distribution over ponds, all supervised by an extensive sanitary staff. In addition, the employees are under strict medical supervision and no small part of the work has consisted in the proper dis-

tribution of quinine to these men. In the period from 1885 to 1890 it is stated that the number of railway employees seized with fever on these lines comprised 87% of the total number of employes residing in the dangerous zone, which included about 700 miles of road. During the year 1911, out of 22,520 employees living under the same conditions, but operating about 2000 miles of road the number of persons stricken with fever was only 13.3% of the total.

## Salt Industry Byproducts

As byproducts of the salt industry in the United States, bromine and calcium chloride are produced. In 1911, the production of bromine was 651,541 lb., and of calcium chloride, 14,606 tons, according to the U. S. Geological Survey. The manufacture of bromine is conducted by concentrating the bittern water to about 41 to 43° Bé., after which it goes to sandstone stills, where it is mixed with sulphuric acid and potassium chlorate. Steam is then blown into the mixture, heating it to a temperature of about 180° F., when the bromine passes off through lead pipes to a condenser. The residual liquor is neutralized with lime, and heated to a thick, sirupy liquid, which is run into drums, holding 600 to 700 lb., where it cools, and forms a solid mass of calcium chloride.

## Solubility Of Gold In Nitric Acid

The solubility of gold in the nitric-acid-combination method for the assay of copper bullion is well known to most assayers. It has been ascribed to the presence of the nitrous acid formed, to the filtration of gold through the filter papers used, and to selenium. Dr. Edward Keller has shown that the rate of cooling of the copper bars exercises a great influence on the amount of soluble gold (*Bull* A. I. M. E., July, 1912). His attention was first called to this by the differing solubility of gold in samples taken from supposedly identical copper cast in large and in small shapes, and was verified on synthetic alloys, cooled at varying rates. The greater solvent action is exerted on the more slowly cooled bullion.

He, therefore, draws the following conclusions, which, however, he is careful to point out, are more or less hypotheses. From what is known of the action of nitric acid, or other chemicals, on gold, it would follow that there would be no discrimination between gold in slowly and in quickly cooled bullions. The difference would, therefore, rationally be sought in the chemical nature of the alloys in the copper as influenced by heat treatment. It seems justifiable to assume that in the slowly cooled bullion, the gold combines with some, or all, of the accompanying elements, forming nitric acid-soluble compounds; that the reaction take place through a narrow range of temperature just above the freezing point, and that its velocity is slow as compared to the speed of cooling; that at higher temperatures the gold compounds dissociate, and that quenching the samples leaves the gold in free state, hence unattacked by the acid. Since neither gold- nor impurity-increase augments the amount of soluble gold beyond a low maximum, it would appear that the soluble gold compounds are formed only in dilute solid solutions.

With a gold-selenium alloy, quenching seems to be ineffective, leading to the idea that either the gold-selenium compound forms at higher temperatures than other gold-metalloid compounds, or else that the dissociation temperature is not reached in the furnace in which the alloys are melted. [This seems to show a rational basis for the prevalent assayers' belief that much of the difference between nitric-acid and all-fire assay can be laid to selenium.—EDITOR.] The highest amount of soluble gold found was 0.0017% of the weight of the bullion.

## Separation of Zinc and Iron

A method which should be of great use to the zinc analyst is given by Koninck and Wininwarter (*Bull.* Soc. Chem. Belg., p. 239, 1912; abstr., *Journ.* Soc. Chem. Ind., July 15, 1912). The authors believed that the retention of zinc by the usual ferric-hydroxide precipitate was due to the formation of a double hydroxide, which they attempted to prevent by the addition of another metal for which iron would have an equal or greater affinity. It was found in the presence of enough ammonium chloride to prevent the precipitation of magnesium as hydroxide by ammonia, that the retention of zinc by ferric hydroxide was completely obviated by the addition of 5% of magnesium, as magnesium chloride, to the solution.

## Cottrell Fume Precipitation

In a recent paper[1] before the American Institute of Mining Engineers, F. G. Cottrell gives further data on his electric fume-precipitation process, an account of the work of which up to July, 1911, we have already given.[2]

The Cottrell system has since been tried at the plant of the Riverside Portland Cement Co., in southern California. An installation was made to treat about 50,000 ft. of gas per minute, issuing from one of the 10 kilns. One of the interesting developments here was that the collected dust runs high in water-soluble potash, and it is hoped that a commercial means of potash recovery may be developed through the use of high-potash materials for making cements.

It has also been applied to handling about 3000 cu.ft. of gas per minute derived from the Pierce-Smith basic converters at the Garfield plant. Both of these installations were successful.

The original cost of the Balaklala installation, treating 250,000 cu.ft. of gas per min., is given at $107,000, and subsequent alterations at $15,000 more. The complete installation at the cement plant, to treat 500,000 cu.ft. of gas, will probably not cost over $150,000. To treat about 50,000 cu.ft. per min. of the cement-plant gas requires about three to four kilowatts. In the Balaklala plant, 120 kw. were required.

[1] "Bull.," A. I. M. E., July, 1911.

[2] Eng. and Min. Journ., Oct. 14, 1911.

## Regulation of Engineering Practice in Austria

A departure is being undertaken in Austria to improve the status of engineers in the community, says *Eng. News*, July 25, 1912. A bill has been placed before the legislature, which will call for the establishment of bodies similar to chambers of commerce or bar associations, but of official character to the extent that membership is required of those practicing engineering. A hearing on the bill was held by a committee of the Abgeordnetenhaus, on July 10, at which a number of speakers for the engineering profession spoke in favor of the bill. The minister of public works also advocated the bill. The committee thereupon approved the bill and decided to report it to the legislature.

## Power Direct From Blast Furnace Gas

The power developed by using blast-furnace gas in internal-combustion engines is double that developed by burning the same gas under boilers, says the London *Min. Journ.*, July 6, 1912. Installations for using the gas in this way are in Germany 480,428 hp., in America 337,490, in France 55,050, in Belgium 46,714, in Austro-Hungary 25,500, in Great Britain 24,986 and in other countries 63,341. The distribution of this power is 855,819 in metallurgical works, 68,200 in coal mines, 34,950 in electrical factories and 74,540 in various kinds of workshops.

## Spontaneous Combustion of Charcoal

There were 63 cases in 1911, in the United States, of spontaneous combustion in charcoal undergoing transportation. The passage of air currents containing sulphur dioxide especially increases the danger, says the National Physical Laboratory. However, wetting the charcoal does not seem to increase the danger of spontaneous combustion.

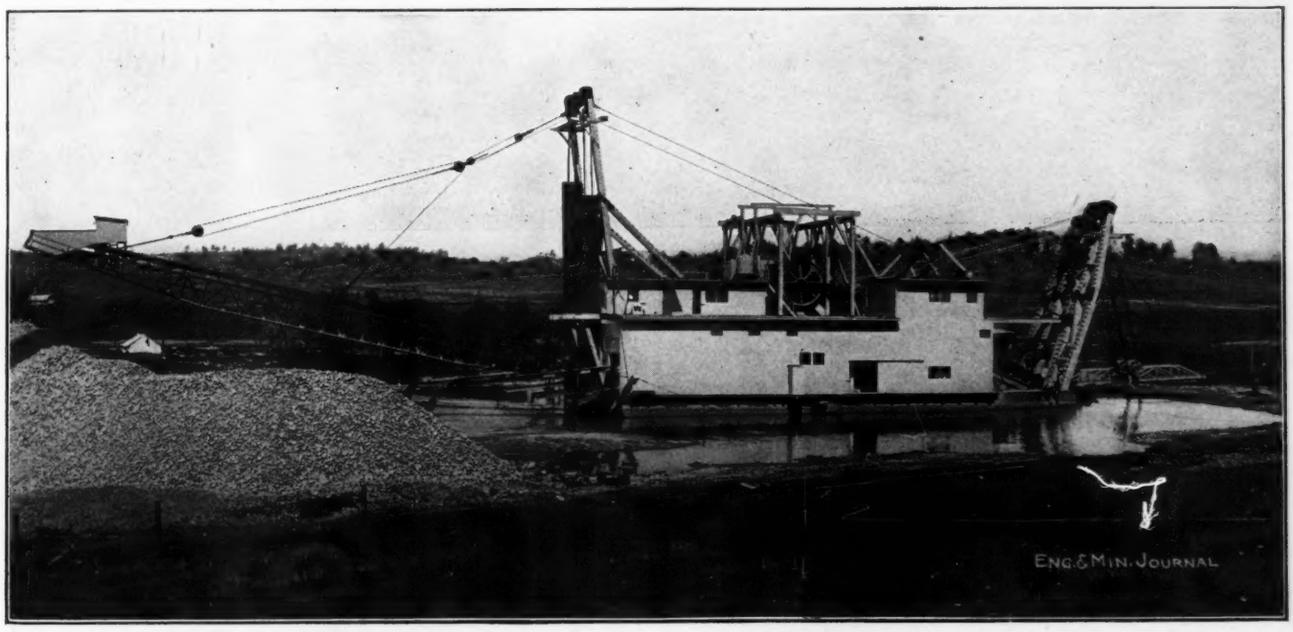
# The Union Dredge at Folsom, Calif.

By Lewis H. Eddy

**The latest boat to be put in operation in the American River district was the 9-cu.ft. dredge of the Union Dredging Co., which was completed in March, 1912, at a total cost of $225,000. This close-connected, bucket-elevator dredge is designed to dig 55 ft. below the water line.**

The 9-cu.ft., close-connected bucket-elevator dredge, installed by the Union Dredging Co., on the Blue Ravine Channel, about 1½ miles from Folsom, in the American River district, California, was started for a trial run on Mar. 12, 1912. It averaged 4025 cu.yd. per day during the test, which is 70% of its rated capacity. The necessary adjustments to bring the dredge up to full capacity were expected to be completed by June 15, 1912.

The Union Dredging Co. was organized under the laws of Delaware in December, 1909; the contract for the dredge was made with the Bucyrus Co., of South Milwaukee, in June, 1911; the construction contract was sublet to the Yuba Construction Co., of California, and work was begun on the ground in the following August; the machinery was in place and the dredge ready for operation on Mar. 12, 1912. The cost of the dredge complete was about $225,000. The head office of the dredging company is at Philadelphia and the local office at Folsom. Edgar A. Gillinder is president; Benjamin C. Warnick, general manager; Andrew Turner, of Folsom, superintendent; George L. Holmes, of San Francisco, consulting engineer.




THE 9-CU.FT. UNION DREDGE AT FOLSOM, CALIF.

### DREDGE DESIGNED FOR DEEP DIGGING

In the employment of 9-cu.ft. continuous buckets rather than a smaller or a larger size, the two chief elements of economic operation, construction cost and operating cost were considered. The character and depth of the gravel, as determined by prospecting, require an especially strong boat of the larger type, as the ground is tight, though no cemented gravel has been found. In order that the results may justify the expenditure essential to such installation, the largest possible yardage is not only desirable but necessary. The dredge is designed to dig 55 ft. below the water line, and it is quite probable that in much of the ground the full capacity will be demanded.

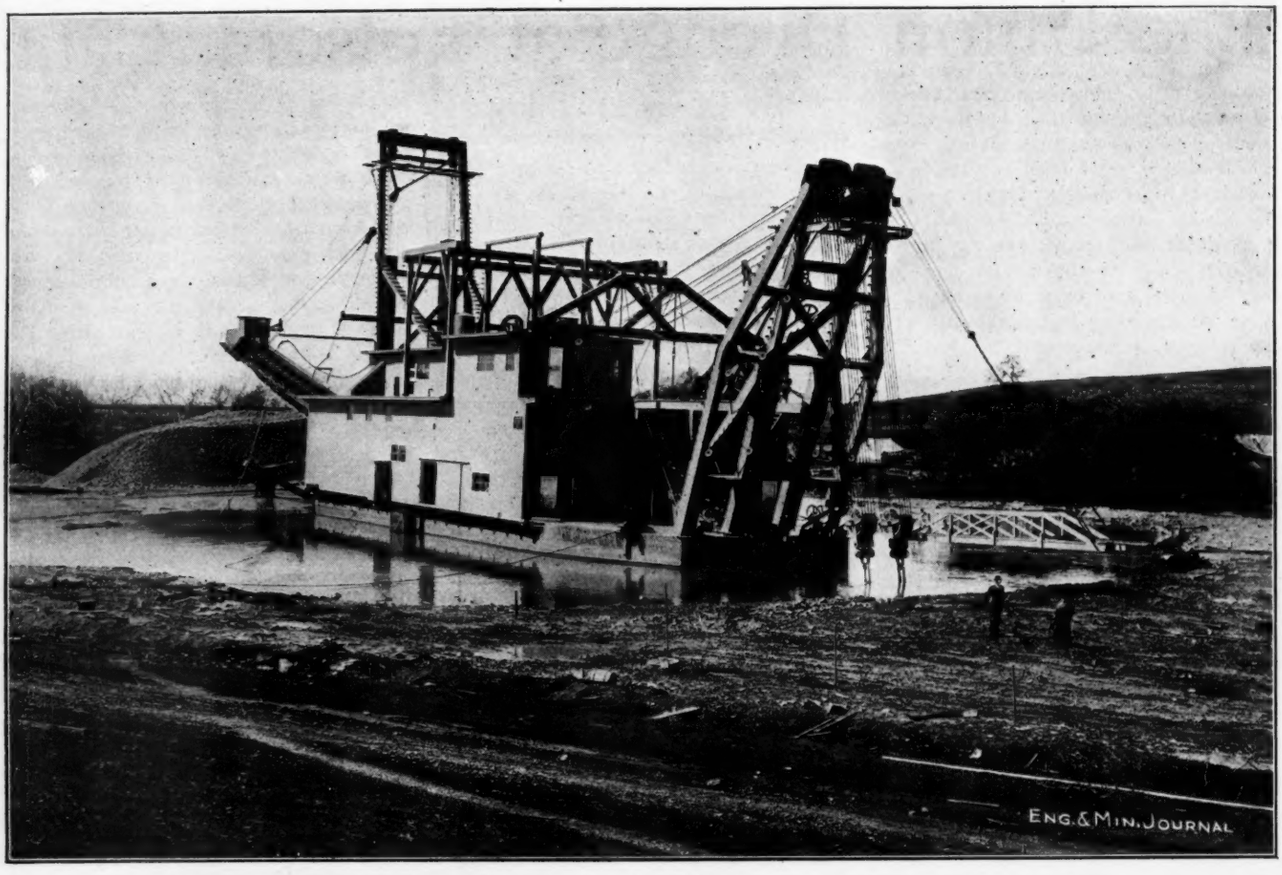
The hull is 135 ft. long, 46 ft. 6 in. wide, 11 ft. 6 in. deep; over 400,000 bd.ft. of Oregon-fir lumber were used in hull and superstructure. The gantries are of the standard type and a little heavier than installed on the Folsom No. 6 boat, and of the usual Yuba Construction Co. make. The digging-ladder frame is of the plate-girder type, hung from an independent ladder-suspension shaft and weighs 138,000 pounds.

The lower tumbler is six-sided, made in halves, the threads being faced with manganese-steel wearing plates. The upper tumbler is a six-sided, single-piece, open-hearth steel casting, with renewable cushion plates. The shaft is of forged nickel steel and is bored hollow. The ladder rollers are 14-in. diameter and are made of high-carbon steel with forged-steel shafts pressed in. The buckets are in three parts, composed of pressed-steel hoods and bottoms and manganese-steel lips. Each bucket has two front eyes and one back eye, the latter provided with a manganese-steel bushing. The bucket pins are above the average size, 6¾-in. diameter and made of high-carbon steel. The ladder hoisting tackle consists of two upper and two lower blocks having 45-in. diameter sheaves grooved for 1⅛-in. rope.

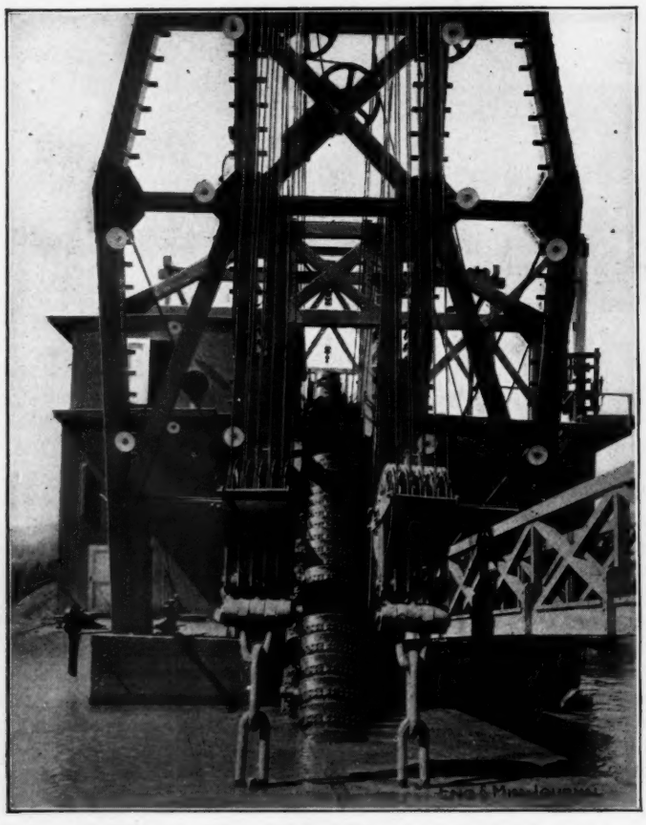
### A 150-FT. TAILING STACKER

The tailing stacker is a 38-in. belt conveyor mounted on a steel truss of 150-ft. centers. The head drum is 42-in. diameter and the lower 32-in. diameter. The stacker belt is driven from its outer end by a motor, situated above the conveyor belt. Cast steel gears and pinions with cut teeth are used in the drive. The stacker winch is a single drum with worm-wheel drive. The dredge is provided with two steel spuds, each 31x57-in. cross-section by 70 ft. long, weighing 124,000 lb. The revolving screen is 7-ft. diameter by 37 ft. long. The perforations taper from ⅜ to ½ and ½ to ⅝ in. The screen is provided with nozzle washers, eight at the upper end and six at the lower end. The gold-saving apparatus is the standard California double-bank type, and has a total area of 3200 sq.ft. The riffles are of wood shod with iron straps ⅛ in. thick.

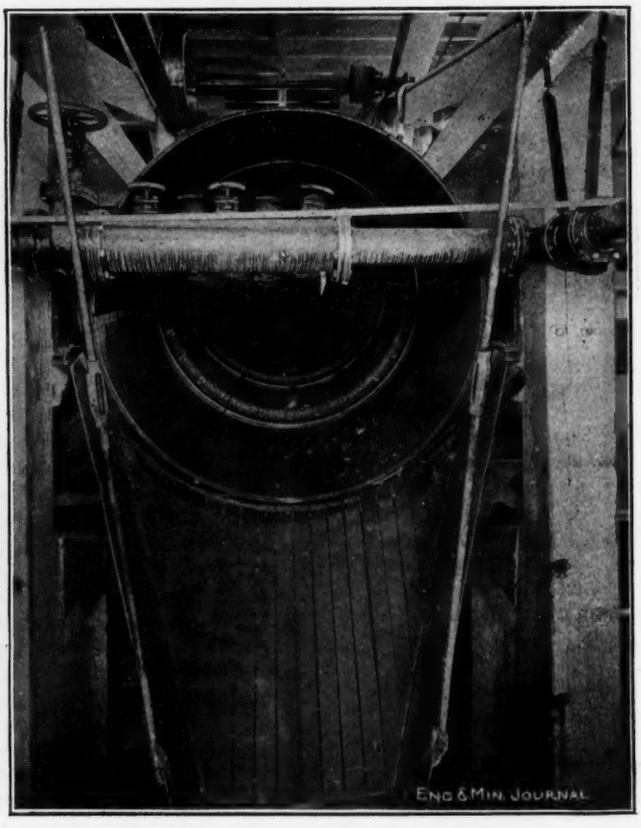
The winch machinery consists of seven drums as follows: One auxiliary long drum mounted on its own shaft; two long




ANOTHER VIEW OF THE UNION DREDGE, DESIGNED FOR DIGGING 55 FT. BELOW WATER LINE



BOW END OF UNION DREDGE; BUCKETS ARE 9 CU.FT., CLOSE CONNECTED




REVOLVING-SCREEN DISCHARGE, SHOWING NOZZLE WASHERS

drums each on its own shaft for the forward swing lines; two short drums mounted on one shaft for the stern swing lines; two drums mounted on one shaft for the spud-hoisting line. All drums are

BELT-CONVEYOR TAILING STACKER

screen, 40 hp.; tailing stacker, 50 hp.; total, 500 hp. The pilot house is equipped with a three-panel slate switchboard with overload circuit breakers for all motors. The wiring is the 3-conductor cable system in a steel conduit.

The monitor equipment includes two No. 1 giants, a two-stage, 10-in centrifugal pump with a capacity of 2000 gal. per min., against 150-ft. head, direct connected to a 125-hp. motor. An automatic time-recording instrument is provided, which is connected to the digging ladder in such a manner as to indicate accurately the different depths of digging and the operating time.

## U. S. Barytes Production

The production of crude barytes in the United States in 1911 was 38,445 tons, valued at $122,792, according to the U. S. Geological Survey. Compared with the production of the preceding year this was a decrease of 4530 tons in quantity but an increase of $1046 in value. The total quantity of refined barytes reported as sold by mills in 1911 was 39,611 tons, valued at $503,867. The greater part of the barytes produced in the United States is used as a pigment in the manufacture of mixed paints.

Barytes occurs in veins as a gangue of metallic ores, also in veins in sandstone and limestone or as a replacement of limestone. The mineral has a wide range in geologic time and an extensive distribution. In the United States the principal sources are, however, limited to two districts—the Missouri district and the Appalachian district. A single county in Missouri—Washington County—produced about 45% of the total output.

**The high price of platinum has led the International Committee of Weights and Measures to favor the use of tantalum (*Chem. Trade Journ.*, Feb. 17, 1912), which is hard and unalterable, and from which standard weights can be made at a third of the cost of those of iridio-platinum.**

## The Parks Electrocyanide Process*

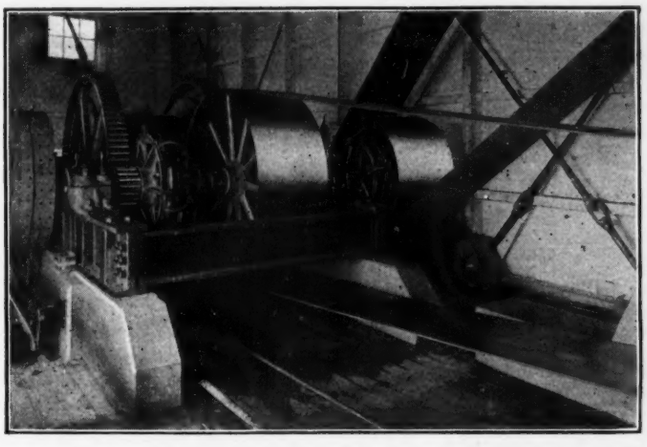
**The object of the Parks electrocyanide process is to apply economically all of the chemical and physical forces necessary to extract and collect the precious metals, applying them at their highest potency, and simultaneously. Ores, in their raw state, were made to yield their precious metals rapidly in the form of amalgam, in a single operation, in a single machine, eliminating all filtering and precipitating devices.**

### COPPER CATHODE AND IRON ANODE PLATES

The Parks electrocyanide pan consists of a wooden tub, 15-ft. diameter and 30 in. deep, through the center of which projects a small conical casting for the passage of the working shafts. Practically the entire bottom of the pan is covered by an amalgamated copper plate, to which quicksilver is automatically added during operation, in proportion to the amount of precious metal in the ore being treated. About 9 in. above the copper, or cathode plate, a cast-iron anode plate equal in area to the copper plate is mechanically suspended. The cast-iron plate is divided into two annular rings, the outer one containing 60, and the inner one 40% of the anode area.

These annular anodes are revolved in the same direction, and independently, by means of pulleys, gears, and a solid and a hollow shaft, so that any midway point of the inner ring travels practically the same number of feet per minute as any midway point of the outer ring. On the lower side of each of the anode rings, wooden paddles 7 in. deep are fastened radially, about 5 ft. apart, the bottom of the paddles being 2 in. above the copper plate.

*Excerpt from an article by John R. Parks, in the Columbia School of Mines Quarterly, July, 1912.



INTERIOR VIEWS SHOWING WINCH AND REVOLVING SCREEN, UNION DREDGE, FOLSOM, CALIF.

17½-in. diameter. Friction clutches of the fiber-lined, internal-expansion type are provided and the brakes are the wood-lined, outside-band type. Fast and slow speed is obtained by change gear with a jaw clutch.

### DREDGE ELECTRICALLY DRIVEN

The dredge is electrically driven, the power being furnished by the Great Western Power Co. All motors are 2200-volt, 60-cycle, three-phase alternating current. The distribution of power is as follows: Bucket-chain motor, 200 hp., variable speed, 600 r.p.m.; starboard winch, 30 hp., 2-bearing type, variable speed, 900 r.p.m.; 12-in. high-pressure pump, 100 hp., direct connected, speed 900 r.p.m.; 12-in. low-pressure pump, 50 hp., direct connected, constant speed, 720 r.p.m.; two-step hopper pump, 30 hp., 2-bearing type, speed 900 r.p.m.; revolving

The compound rotary motions of the anode rings and their paddles give to the pulp confined between them and the cathode plate a uniform spiral motion outward, keeping the ore in a perfect state of suspension, and at a little higher speed than pulp travels down a stamp-battery plate. By the centrifugal force of the paddles, the pulp on reaching the staves of the pan is forced up between them and the outer edge of the outer anode to a height of about 16 in. above the anode, retaining the rotary motion imparted by the paddles and now endeavoring, by gravity, to seek the lower level at the center of the pan; the resultant motion is a downward and inward spiral until the ore passes over the inner edge of the inner anode, near the center cone, when it again meets the paddles and starts to repeat its cycle of travel.

### Compressed Air Furnishes Oxygen

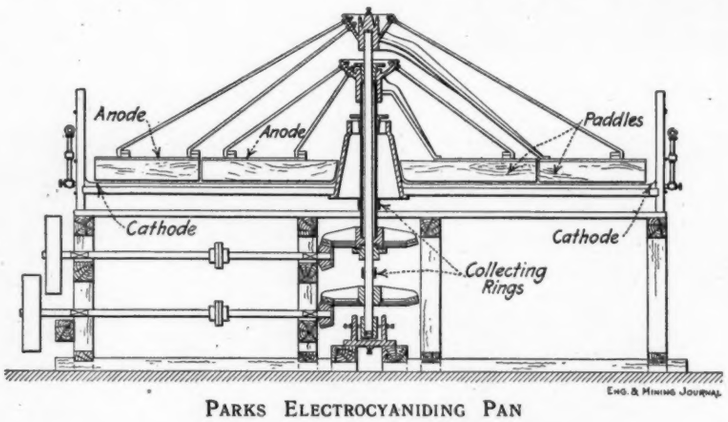
At the periphery of the pan, and on a level with the cathode plate, 20 jets of compressed air are admitted through needle valves set at regular intervals around the pan. The air pressure—about 12½ lb. per sq. in.—is sufficient to overcome the centrifugal force of the pulp against the valve exits and to keep them clear. The amount of air is calculated from the oxygen demanded by Elsner's formula for dissolving the precious metals by cyanide salt, with an allowance for unavoidable waste in mixing. The air, on leaving the valve, travels against the outward spiral motion of the pulp between the anode and cathode plates, and nearly all the excess makes its appearance as a light effervescence around the center cone, being thoroughly incorporated with the pulp; comparatively little escapes by rising to the surface without passing between the plates. At 100 lb. pressure, 1½ ft. of air per min. is an ample supply for the pan during treatment.

During the last eight years I have experimented with many iodine, bromine and other compounds, seeking economy and efficiency, and have found nothing so effective and economical as commercial potassium or sodium cyanide, or the commercial double salt, together with common lime and common salt, aided by the sodium amalgam and caustic soda generated by the process.

The electrical factor of the process which consumes from 75 to 80% of all the physical power necessary to operate it, and accounts for the speed, efficiency and economy of this as compared with other processes, is worthy of considerable attention.

From a 10 to 12-volt, 400-ampere, direct-current generator, the positive wire, after leaving the switch and indicator board, is led to the mechanical portion of the pan in four branches, each of which terminates in a suitable brush; two play against the copper collecting ring on the solid shaft which drives the outer annulus of the anode, and two against a similar ring on the hollow shaft which drives the inner annulus of the anode. By this means, the electric current passes up the vertical driving shafts, insulated from the cone through which they pass, and proceeds down the driving arms and supporting rods to the anode annuli, where it is uniformly distributed.

The negative wire from the electric generator, after passing through the switch and indicator board, also terminates in four branches, each of which connects with a copper tail piece projecting through the pan, each tail being a portion of one of the four segments of the copper plate forming the cathode. Owing to the insulation of the machine, all the electric current must pass from anode to cathode through the pulp.




Parks Electrocyaniding Pan

### Cyanide, Mercury and Salt Used

In treating a charge consisting of 7½ tons of ore (dry weight) with an equal weight of water, and containing its quota of lime previously added during the crushing of the ore, such an amount of strong cyanide solution is added as to equal 1 lb. of cyanide salt per ton of ore in the pan. After addition of cyanide, finely crushed common salt is added until the ammeter registers 300 to 500 amperes, at 9.5 to 10 volts, as determined by a test run. The pan is then put in motion, the air is turned on, and the quicksilver is put into its distributor. Many complex chemical compounds are formed, some of which are decomposed, in a manner which baffles the skill of the electro-chemist to explain, but among the established effects of the electric current the following may be stated:

The salt is decomposed by the electric current and metallic sodium is constantly precipitated on the mercury-coated copper plate, forming sodium amalgam; the sodium is converted into caustic soda, by its reaction with water, which, uniting with acid radicals in the ore, protects the cyanide from compounds from which the lime does not so readily protect it, thus saving a much larger portion of cyanide salt than can be saved without the current. Chlorine is also generated, but rarely indicates its presence, probably being united with basic radicals of the complex charge.

These several ions travel very slowly in quiet solutions, but in this mechanical device the pulp travels an average of seven miles over the copper plate in a 2½-hour treatment, presenting the cations rapidly for discharge and deposition. This is analagous to the method by which copper is precipitated on a platinum dish, in modern electro-analysis for copper, by a revolving anode in a small fraction of the time required for precipitation in quiet solutions.

The cyanide anion probably seizes a potash or soda radical and is reconverted into nascent cyanide salt, unless a particle of precious metal, for which it has a greater affinity, presents itself first. However, there can be no question as to the so called restoration of cyanide, for I have frequently found much more free cyanide of potash or soda in a sample of solution taken a half hour or an hour after a previous sample.

### Loss of Mercury Small

Theoretically no mercury can be lost by scouring or flouring in the charge, as any subdivided particle of this metal too small to seek the cathode by gravity is sufficiently small to yield to electro-cyanide solution, whereby it is electro-chemically precipitated back on the plate. Practically, a small amount is lost, for in a 2500-ton run on Ruth ore a loss of about 5 lb. was reported.

On samples containing 0.8575 oz. of gold per ton, I have reduced the average tailing sample to 0.0075 oz. per ton, showing an extraction of 99.1% by six hours' treatment in the electric pan, using 1 lb. KCN per ton of ore; the same ore, reduced to the same fineness, yielded but 92% to solution in 48 hours' treatment in Pachuca tank (generally recognized as

one of the best aero-agitating devices) using three tons of solution containing 3 lb. KCN per ton, or 9 lb. of cyanide salt per ton of ore.

### Base Metals also Precipitated

Many of our Western precious-metal ores from oxidized zones are contaminated by carbonates of lead, zinc and copper, which preclude economic treatment by the ordinary cyanide methods, owing to the difficulty in precipitating the precious metals in the presence of the cyanides of the base metals, aside from the excessive consumption of cyanide salt. The electric current, however, precipitates the base metals as well as the precious metals, on the amalgamated plate. I have produced, by the electric pan, bars of bullion worth $1200 or $1400 which averaged but 512 fine in precious metals, the other 50% of the bars being lead, zinc and copper, alloyed with the precious metals.

As precipitation of precious metals takes place more rapidly from strong than from weak solution, in treating certain ores economy can be introduced by discharging the pan at a fixed value of unprecipitated precious metals in solution (50c. to $1 per ton). After passing the charge through a revolving settler used as a precautionary amalgam trap, it may then be sent through a Dorr thickener, whereby 50% of the solution from a 1:1 charge, and 80% of that from a 1½:1 charge, can be returned clear for original charges; this not only saves time and increases the daily capacity of the plant, but secures a higher percentage of recovery of the precious metals, while preventing undue waste of common salt and unused cyanide.

The total power required for a single pan is 0.6 hp. for mechanical agitation; 1 to 1.5 hp. for compressed air; and 4.5 to 6 hp. for electric current. The capacity of the pan depends on the amount and character of gangue in the ore and on the nature of its precious-metal minerals. The proportion of gangue determines whether one ton of ore may be treated with one ton or will require 1½ tons of water; none but the exceedingly clayey types require the 1:1½ charge.

### Capacity 36 to 60 Tons Daily

A single pan charge of the 1:1 class is 7.5 tons of ore, dry weight, and of 1:1½ ore, is 6 tons; the time required for treatment varies from 1 to 12 hours, generally being 2½ to 4 hours; hence the capacity of the pan, allowing for charging and discharging, varies between limits of 15 and 90 tons per diem, but on the average run of ores it varies from 36 to 60 tons per diem.

The large capacity of the pan, the small tonnage of ore under treatment in the mill at one time, and the small amount of machinery and apparatus required, reduce the total cost of installing mills using this process to 30 to 60% of the amount necessary to install any other process of equal daily capacity.

### High Extraction Obtained

A few examples will show the efficiency of the process. At the Ruth Gold Mining Co.'s mill, Kingman, Ariz., the daily capacity is 50 tons. The ore is quartz with a large amount of manganese minerals and but little free gold. The precious metals occur in sulphide minerals; the ratio of gold to silver is 1 to 12. The test was made in a 40-in. testing plant. A 215-lb. charge of 200-mesh pulp was given a 6-hour treatment, 1 lb. of KCN per ton of ore being used. The results were as follows: Precipitated as amalgam, gold 96.76%, silver 87.7%; total extraction 95.6% of the value of the ore. Shortly after the mill was turned over to the Ruth company, three pans being used, each with 7½-ton charges, the assays of the mill foreman's samples showed that on an $18 ore using 1-lb. KCN solution, after 6 hours' treatment 96.66% of the gold and 87.77% of the silver were precipitated as amalgam, the total extraction being 95.09% of the value of the ore.

At the Maginnis mill, Maiden, Mont., one pan is used in which 7½ tons of 30-mesh pulp are treated. The ore, containing 0.33 to 0.50 oz. gold and from 1.5 to 4 oz. of silver per ton, is contaminated with the carbonates of lead, zinc, and copper. By a 2½-hr. treatment with 1 lb. of KCN per ton, 86 to 92% of the gold and 62 to 72% of the silver were precipitated as amalgam. The low silver contents of this ore prohibited the economic use of cyanide salt in stronger solutions, in order to secure higher extraction from its silver minerals.

An ore from Kendall, Fergus County, Mont., a decomposed, porous limestone, impregnated with gold, was an ideal cyanide ore. A test on 225 lb. of $8 ore, crushed to 12-mesh, gave the following results with 1 lb. of KCN per ton. After one hour, 90.5% of the gold was precipitated as amalgam; after 2½ hr., 97% was precipitated.

An ore from Orient, Wash., an auriferous pyrite in andesite with no free gold, averaging 1.03 oz. per ton, yielded 95.35% of its gold as amalgam after a 4-hr. treatment with 4½ lb. of NaCN; the pulp was 120-mesh, lots of 230 lb. each being treated.

At the Whitman mine, Pearl, Idaho, the ore contains 25 to 27% arsenical pyrites, 40% pyrite, and 35 to 37% gangue, a 6-hr. treatment with 41 lb. KCN; of 120-mesh pulp assaying 1.3385 oz. gold gave an extraction of 88.8% in the form of amalgam.

Ore from the Metates mine, Sinaloa, Mexico, containing 5% pyrrhotite, with galena and antimonial-sulphide minerals in quartz gangue, assayed 0.625 oz. gold and 63.015 oz. silver. After a 12-hr. treatment of 230 lb. of a 120-mesh pulp with 12 lb. of KCN, of which 7.7 lb. were consumed, an extraction of 99% of the gold and 91.1% of the silver was obtained. All of the results cited above were obtained by direct pan treatment, without returning any solution once passed through the pan.

## Advantages of a Level Stope

By H. Y. Russel*

In deciding to carry a level stope there are at least two factors that must be considered; the question of cheaper mining cost, and the effect on the ore output.

The usual method of opening stopes is to start drifts along the vein from the shaft. These drifts are from 6½ to 8 ft. high. After the drift has been driven for 150 or 250 ft., the machines are taken to a place about 50 ft. back from the breast and are used to drill down five or six feet of the roof; this is sometimes called the "cutting-out stope." The timbers to hold the stope are then put in under the heightened roof, and stoping is started.

### The Inclined Stope

Driving is again begun in the drift and at intervals the cutting out for the stope is repeated, the stoping length being gradually extended. Under this process stoping starts near the shaft, and by the time the stope is cut out 500 ft. along the drift it is 50 or 60 ft. high where it was first started, and is carried upward on an incline rising from the drift to its highest point near the shaft. In some cases the incline becomes steep owing perhaps to the high part of the stope running into a barren zone and necessitating for a time a larger amount of ore from the lower end.

The difficulty of keeping such a stope in condition for easy travel is apparent. The time taken to carry machines, mill timbers, rock or supplies, is considerably greater than if a good footway could be kept. The men going to their work and the shift bosses going their rounds take much longer than they should, all of which adds to the cost. I do not think that one realizes the additional amount of work that a man in a level, well kept stope will do, until he has had experience with the different methods.

In blasting on an incline it frequently happens that the ore or waste will run

*Mining engineer, 423 Guy St., Montreal, Canada.

down the slope, blocking it completely, delaying the men going on shift, interfering with the ventilation and burying tools, etc., that have been left in places where in a level stope they would have been out of range of the blasted rock. In the hurry to get the stope cleaned and work started these tools are not seriously sought for; then they are forgotten. Furthermore more ore is lost in a rough stope than in a well kept one.

### The Level Stope

The method of opening a level stope is not unlike that for the inclined one. It is necessary however to carry the development farther ahead and to open more stoping ground before taking out ore. The ideal length for a level stope is that where every man working can be kept busy for the whole shift. A stope in which enough drilling can be done in five hours to keep the shovelers, timbermen and trammers busy eight hours is not getting good results. It is impossible to move men and their tools from one stope to another without waste of time.

In opening level stopes the output must be considered. As the vein is developed an idea has to be arrived at as to what the output should be to give the best returns. When this has been decided enough stoping ground must be prepared to keep this output coming steadily. To give some idea of the length of stope necessary to maintain a certain output I might refer to a case that came under my personal observation. The mine in question was one of the most efficiently worked properties I have known. The property was equipped with a mill of a capacity of 134 tons per day.

To maintain this output 1800 ft. of stoping back was necessary, the vein being about three feet wide. There were three stopes on three different levels, each stope being about 600 ft. long. The average daily raise in the stopes was 0.31 ft. This will give some idea of the amount of stoping ground necessary to maintain such an output.

### Development

It will be seen that the development for an inclined stope is rather less expensive than that for a level one. With the former results are obtained from the development every 50 or 100 ft., in the latter 1200 to 1800 ft. of development must be done before stoping may begin. This gives the level-stope method a higher cost of maintenance for the opened drift and it also requires a larger development fund.

In opening new stoping ground for the level stope 300 ft. seems to be as short a stope as can be economically worked. On the supposition that three levels are producing 134 tons per day, and that the vein removed to furnish this tonnage from 1800 ft. of backs amounts to 16,740 sq. ft. per month of 30 days, it is necessary to drive, cut out and timber about 170 ft. per month with levels 100 ft. apart. This is 57 ft. per level, about what is usually done in ordinary mining work. This makes about 5½ months drifting before any ore is forthcoming, and much money is tied up, but I think it is more than compensated for by the cheaper mining done in the level stope.

### Results

In discussing results I will have to refer to the mine already mentioned. The stopes were about 600 ft. long and were raised between manways; there were additional manways every 100 ft. and chutes 25 ft. apart. There was seldom a difference of more than two feet in the length of any of the chutes. The stopes were well kept, in fact were more like sidewalks than any stopes I have seen. Two hammer machines were used in each stope in the day shift; in one stope where the ground was harder two machines were used on the night shift; eight machine shifts per day in all.

The machine men did nothing but drill. They would start drilling within 8 or 10 min. after reaching the stope and drill until tally. In two stopes each machine took care of 300 ft.; in the other stope two machines were put on 300 ft. Before tally the foreman marked such holes as he wanted blasted and they were shot by a man who also did other work. When a man got his 300 ft. of stope drilled he came back to his starting point and drilled through again, always keeping a little ahead of the blasting. The stope was filled with waste obtained by shooting down the walls which were drilled by the machine man as he went along. The result was that the eight machines broke 124 tons of ore per day (allowing 10 tons per day from development, a fair allowance in this case) and filled the stope, a duty of 15½ tons of ore, and allowing for the chutes and manways, an equal amount of waste or a combined duty of 31 tons per hammer machine per shift.

The same good service ran all through the mine crew, the total number of men employed in and around the mine to produce 134 tons, excluding only the manager and bookkeeper, was 60. Not many mines working narrow veins can show such a high standard of work and I think it was largely due to the ease and quickness with which the men could move through the stopes. While it was impossible to figure accurately the saving by the level over the inclined stope, it was considered about 35c. per ton.

### Effect on Ore Output

In the majority of fissure veins the ore is secondary; it either has been enriched or has been redeposited. I have seen these orebodies of a length of 5000 ft., 1000 ft. is not uncommon. In these orebodies there are occasionally horizontal zones of pinching, which are not usually high but may last through five or six feet vertically. Nearly all fissures show minor variations or folds in the dip, and when one wall slips down before the fissure is filled it will pinch the flatter part of the fissure and widen the more nearly vertical part, so that when the vein is formed there will be lean zones where it flattens.

The whole back of a level stope may run into one of these lean zones almost at once and for from two to three weeks a startling reduction of tonnage will ensue. It is quite possible however to foresee this condition as the vein pinches gradually, flattening as it pinches. In order to protect the output two plans are available. One is to have additional stoping backs ready; the other is to use the stope chutes as storage pockets. These chutes are built 4½ ft. square in the clear for the first 25 ft. above the drift, they are then drawn down to two feet square. This pocket gives storage for about 29 tons or in a 600 ft. stope about 400 tons allowing certain chutes for waste; a very fair storage considering the extreme improbability of all stopes running out of ore at once. If this should happen the level-stope system would break down. An inclined stope does not run this danger as only a small portion of the back can run into pinched ground at any one time.

## U. S. Production of Magnesite

The U. S. Geological Survey reports a decline in the production of magnesite for the year 1911, the output being 9375 short tons, valued at $75,000, against 12,443 tons, valued at $74,658 in 1910. The advantages which will result from the opening of the Panama Canal are tending to revive interest in the California product, which is recognized as high-grade. Magnesite is quoted at the California mines at $8 per short ton, but the Eastern and Mississippi Valley markets are supplied by importation. Imported magnesite is quoted at $10@11 per long ton for the raw and $30@35 per long ton for the calcined and powdered product at New York. These figures indicate why the use of the California product is limited practically to the State. It is hoped that the opening of the Panama Canal will tend toward bettering the condition of the California producers. The imports in 1911 amounted to 122,075 short tons of calcined and 12,974 short tons of crude magnesite.

# Mining Copper at Lake Superior—IV

By Claude T. Rice

**Drift-stopes and raise-stopes are characteristic of the development in amygdaloid practice. A typical drift-stope is 9x19 ft. in section. Progress of a drift-stope averages about 50 ft. per month, and about 40 ft. for a raise-stope. All holes are blasted at the end of each shift.**

Because of the greater weight of the hanging wall in the workings along the conglomerate lode, the drifts and raises in those mines are made small and agree more nearly with Western practice. The size of the raises is about 7x7 ft., and the drifts are generally about 8x8 ft., although in the Red Jacket workings, drifts are driven 7x11 ft. to permit double tracks to be used to serve the stopes. In the Tamarack mine, the idea of obtaining tonnage from the development workings was tried in the conglomerate but with disastrous results, as small fortunes have since been required to keep these drifts open. Huge railroad tunnels, 20x20 ft., were driven at first, as they did not cost much more than the smaller drifts.

### Characteristic Development in Amygdaloid Mines

The amygdaloid mines contain the characteristic development in the copper country, as the remarkable strength of the hanging wall permits drift stopes and raise stopes. It should be remembered that ore reserves in the Lake district are not measured in tons having a certain assay value, but that they consist of blocks of ground, ready to stope, containing a certain tonnage that it is assumed will yield at the mills, about as much per ton as similar appearing blocks of ground have averaged in the past. In conglomerate workings, the grade can be determined more accurately if large samples are taken, but not so in the amygdaloid mines. Until the ore has passed through the mill and the copper has been recovered, its real grade is merely a matter of opinion, formed from previous experience with ore from that mine. For that reason, the drifts are driven to enable the ore to be stoped rather than to develop tonnage, as in the West, and consequently there is no stimulus from necessities of tonnage development, to urge speed in drifting.

It is purely a question of doing the drifting in a manner that will result in the greatest ultimate profit from a block of ground. Therefore, the drifting becomes an integral part of stoping, as tonnage is even sought from the stopes. This was not always the case in the copper country; at one time, the drifts, as in other parts of the country, were considered to be principally for development purposes and were driven small, but it was found difficult to keep the muck out of the way of the machine men. There was trouble in turning the small drift with the vagaries of the hanging wall, as it is desirable to strip the hanging wall clean in the amygdaloid as the drifts are advanced. It gradually became customary to use large drifts drilled from a side set-up, as the turns could then be made easier, the muck interfered less with drilling than formerly, and the ventilation was better because there is an outward and inward current of air maintained in the larger drifts. It was finally found that with two-man machines, it was more economical to make the drifts still larger and to combine cutting-out stoping with the drifting.

### Shallower Cuts With One-Man Machines

With the one-man machine now being used, it is not necessary to get in such deep cuts or to make as great an advance at a squaring of a drift, as when two men work on a machine. With one-man machines it has generally been shown to be the most economical in drifting, to take a depth of cut such that the man can square his drift in a shift, provided the ground will break to the bottom of the holes. There is less trouble with ventilation because there is less muck left in the drift. It is likely that the advent of the small one-man drill will have a marked effect on the drifting and raising practice in the district, as well as on the stoping. It has already been found that drift stoping is cheaper with only one man at the machine than with two. The principal reason that there is such a likelihood of the drifting practice changing is that of the difficult angle at which the holes in a drift stope must be started. Fig. 1 shows this clearly.

Owing to the angling character of the holes, about 3 ft. of hole must be drilled per ton of rock broken in a drift stope, while in stoping only a little over half that depth of hole is necessary. With the one-man drills it might be wiser to use more dynamite and less hole. The drift stopes in these flat-dipping lodes are driven 9 to 10 ft. high and from 16 to 25 ft. wide, according to the strength of the hanging wall, for they are driven so that the bottoms of the pillars, left in the stopes to protect the levels, will come at the top of the drift stope without further cutting away of ore under the pillars. The drawback to this drift-stope practice comes entirely from beginning stoping before the drift stope has reached the boundary on that level, and this crowding of the real stope on the heels of the drift stope comes from the fact that the latter cannot be driven nearly as fast as could smaller drifts. When these drift stopes strike poor rock that has been found on several other levels, the size of the stope is drawn in to 8x10 ft., and continued at that until good ore is struck again. This contraction of the drift does not seem to affect the ventilation in the drift stope to any great extent.

### Practice in Raising

The practice in raising is not always to drive a raise stope, for in some of the mines a small raise is put through from level to level. While this seems to be the better practice, it is not the one generally followed. A raise is generally considered as being driven primarily for ventilation, and secondarily to give access to a stope from above. With this in view it seems contrary to good practice to enlarge such an opening to a size 25 ft. long and as wide as the width of the lode. The idea in doing it is to get more water holes, and to have a greater proportion of the holes breaking with full efficiency, thereby cheapening the cost of the tonnage coming from the workings. The question still remains as to the advantage of doing stoping in an opening that should be hastened to get ventilation. It is necessary to burn out the cut in either the raise or the raise-stope, and it is questionable whether the more efficient holes are drilled in the raise itself or are left to be put up in the stope. Ventilation, of course, is better in the large raises than in the small ones, but this advantage is more apparent than real, since during the time that the raise is being driven the ventilation of some other working is being delayed. The tonnage costs are lower than in a small raise, but little gain results, as the tonnage from a small raise would not amount to much. The raise-stope, however, has its field in helping to keep stamps going with ore from a mine that is not opened far ahead of requirements.

### Piece-Meal Blasting in the Drifts

Another feature of the development work in the Lake copper mines, is the piece-meal drilling of the rounds in all workings and the blasting at the end of each shift, of all holes drilled. This is done because the amygdaloid ore is much broken by fractures that run parallel with the strike of the lode, and better progress can be made by blasting the holes in re-

lays; in this way the men on the next shift can take full advantage of any joints and slips that may show up and also they can see how the holes break in these large rounds, for a miscue in the breaking of one hole might tie up a round and cause a number of holes to break badly. The rounds are not drilled in any of the workings as they would be in the West; in all development work in the amygdaloid and conglomerate mines, full advantage is taken of the good wall from which to draw the cuts. In the drift-stopes the cut is drawn from the hanging wall in what is called the corner-cut arrangement of the holes, while in the shafts and raises, in both the conglomerate and the amygdaloid, the cut is generally drawn from the foot wall. In the latter event, the holes are drilled to take out the ground with a center-V cut, although in some cases, depending upon the strength of the hanging wall, the cut is drawn from the latter.

Experience in the conglomerate lode has shown that the roof in the stopes stands better if a brow of ground is left along the level to help support the hanging, while cutting-out stoping is going on to make room for timbers. There is also a better developed slip along the foot wall than along the hanging. For these reasons, the drifts in the conglomerate mines are driven following the foot wall, and a corner cut is taken off that wall. These holes are drilled in a manner to throw the ore to one side in the drift, and the floor of the working on the side that the set-up is made, is kept fairly clean of muck and the miners do not have to do much shoveling to get a set-up. Not much advantage is gained by the piece-meal blasting in the conglomerate mines, as that ore is not broken up so much by slips and joints as the amygdaloid. In the Tamarack mine it is the practice to drill the whole round before blasting any of the holes.

### Pyramidal Cut in Tamarack Drifts

In the Tamarack mine, to push the drift to the boundaries as rapidly as possible, two machines are used in some of the drifts, although all of the drifts are driven 9x10 ft. Because of the use of two machines, the ordinary corner cut has to be abandoned, and instead, a central, four-hole, pyramidal cut, looking slightly downward so that all of the holes of the cut may carry water, is used. These four holes are drilled so that they meet at a point, and are chambered before being blasted, so that the ground between them at their apex will be burned out and room made for loading them with a large charge. A good cut is obtained in this way. The other holes in this round are also chambered at the Tamarack. In this respect the practice differs radically from that of the other mines in the northern part of the district.

About one stick of dynamite is used in springing a hole. A drift can generally be broken with 18 holes, there being three lifters, three back holes, and three rows of four holes each, in between. Occasionally an extra hole or two has to be put in to insure breaking of the entire round. The cut holes are fired first; then the enlarging holes and the holes for squaring up the drift. From 7 to 7½ ft. of advance are made per round, as the holes break to the bottom, and about 25 ft. of holes are drilled per shift. When drifting with two machines on a vertical bar, and drilling day and night shift, an advance of from 90 to 110 ft. per month is made. Because of the blasting of this round practically at one time, an enormous pile of muck results. To avoid delay, therefore, the machine men set up on a short post 2½ or 3 ft. long, having a two-screw pack. From this short post they drill the top holes of the next round. Meanwhile the muck is being cleaned out so that the machine men can get a set-up on solid bottom.

### Drifting Speeds

In the one-machine drifts a corner cut is taken off the foot wall. To make the cut, turn it and square up the drift, requires from 18 to 20 holes and in this round the holes are also chambered with a stick of dynamite before being loaded. Owing to the large pile of muck that results, the machine men in the one-machine drifts also set up on top of the pile with a short post and drill the top holes of the next round while the drift is being mucked out. With two men on the machine, drilling day and night shifts, an advance of 50 to 55 ft. per month is made. A slightly greater advance is accomplished per round in the one-machine than in the two-machine drifts owing to the use of the corner cuts, as the pulling of the ground from the foot wall permits a better cut to be obtained than when with two machines in the drift a center cut must be resorted to. As far as footage costs are concerned the one-machine drifts are, therefore, cheaper to drive. However, when the development work is behind in the mine and the boundaries cannot be reached on a level before stoping begins, it probably pays to spend a little more per foot of advance in order to be able to reach the boundaries sooner.

### Drifting in the Calumet & Hecla Conglomerate Workings

In the Red Jacket and the other conglomerate workings of the Calumet & Hecla company, the drifts are all driven with one machine. At the Red Jacket these drifts were formerly 7x7 ft. but in order that two tracks can be laid so as to permit timber to be taken to the stopes without interferring with the trammers, the drifts are now made 7 ft. high and 11 ft. wide. A corner cut drawn off the foot wall and drilled to expose about 2 ft. of foot wall, is used. From six to eight holes are generally required to get the cut in properly, but most of these are short top holes, necessary to pull the toe that remains in the last round, and are not over 2 to 3 ft. deep. After a depth has been attained, equal to about half of the distance to be advanced in the round, the cut is turned. The turning holes are each 8½ to 9 ft. deep, as they are drilled from a side set-up. The rest of the holes in the round, those drilled to square up the drift and pointing straight with the direction of the drift, are put in about 8 ft. deep as an advance of from 7 to 8 ft. is made. From 22 to 24 holes are required in a round and it takes from four to five shifts to do the drilling. The holes are blasted in three volleys, as fast as they are drilled; first the cut, then the widening-out holes and finally the squaring holes. None of the holes are chambered as it would take too much dynamite per round, for low cost and not speed of advance is desired at the Calumet & Hecla mines, where development is always kept well in advance of mining. At the Red Jacket an advance of 38 to 40 ft. per month is made in these drifts.

At the south Hecla workings of the Calumet & Hecla, an 8x8-ft. drift is used and this is generally drilled with a corner cut drawn off the foot wall. A round of from 20 to 21 holes is required in them and an advance of about 7 ft. is made. Each shift the miners blast the holes that they have drilled, tearing down the post when blasting all but the cut pop-holes. Because of the narrow drift, this necessitates more shoveling by the machine men to get a set-up, than in the larger drifts, but it pays as the men can judge better how much burden to place on these holes. It is harder to judge this in the case of the corner cut than it is in the drift rounds such as are used in the West. In these 8x8-ft. drifts a monthly advance of about 50 ft. is averaged, it varying from 48 to 54 ft., as seven cuts per month are averaged. Because of the angle at which they are drilled, most of the holes in a round are 8½ ft. deep and about 24 ft. of hole are averaged per shift. The mucking in these drifts is done on day's pay, while the drilling is all done on contract.

### Drift-Stopes in Amygdaloid Mines

The width of the drift-stopes in the amygdaloid mines varies according to the strength of the hanging wall, for that determines the width of ground that can be left unsupported over a level. The typical size of one of these drift-stopes is 9x19 ft. That width prevails in the Osceola workings of the Calumet & Hecla

company, the South Kearsarge mine of the Osceola Consolidated, the Ahmeek and the Centennial mines. In the Allouez, because of the shattered condition of the hanging wall in many places along the lode, the size of these drift-stopes has been reduced to 9x16 ft., while at the Wolverine, owing to the strength of the hanging and the width of the lode, they are enlarged to 11x25 ft. In the North Kearsarge, the drift-stopes are driven 10x16 ft. in section.

In all of these drifts, the foot wall is carried up at the dip of the lode as soon as the stoping width is reached. However, at the Mohawk mine, the drift-stopes, instead of following up on the foot wall in their upper parts, follow the hanging wall with an approximately rectangular section, 12x20 ft. in size, contracted in some places to 12x16 ft. The vein in much of the Mohawk work-

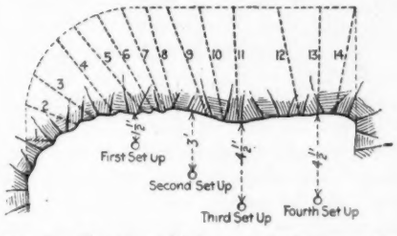



FIG. 1. PLAN OF HOLES IN A DRIFT-STOPE

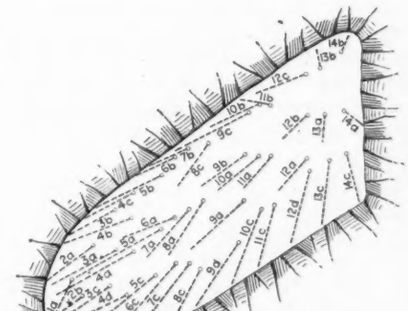


FIG. 2. DRILL HOLES IN A DRIFT-STOPE ON THE OSCEOLA LODE

ings has a width of 20 ft. measured perpendicularly from wall to wall and this drift generally comes inside of the vein, there never being more than one hole in rock at the bottom of the drift. The drift is wide enough to accommodate two tracks so that in case stoping must begin in an outside stope, before the drift-stope has reached the boundary of the ground to be mined through that shaft, as is generally the case, switches and a double track can be placed at that point so that the mucking in outside stopes does not interfere with the tramming from the drift-stope within. The width of the vein in the Mohawk permits such a drift as this to be driven with a flat floor, but at the other mines where the ore is narrower, this method cannot be used unless narrower cars are used.

### CUT TAKEN FROM HANGING WALL

As shown in Fig. 1, in drilling a round in one of the drift-stopes, the cut is taken from the hanging wall in the lower corner of the stope. A few drawing pop-holes, 2 to 3 ft. deep, are first put in to take out the toe of ground left from the preceding round and then deeper holes are drilled to carry in the real cut. The cut having been worked in 3 or 3½ ft. by these holes that draw the ground from the hanging-wall line of weakness, enlarging holes are drilled to work the cut in to a depth of 6½ or 7 feet.

In the Osceola lode this cut requires from six to eight holes according to the number of pop-holes required to take out the toe from the preceding round, and all these holes are drilled from a vertical bar set about 7 ft. from the lower side of the drift-stope.

The cut is then turned with from 16 to 20 holes according to how many of the holes are considered to be part of the cut, as in the Osceola lode it takes approximately 28 holes to put in the cut and to turn it. By that time a space has been obtained in the drift parallel to the strike of the lode, and the enlarging or squaring-up holes have a good chance to break. These last holes have almost as good a break as in a stope, so that the amount of ground on the toe is increased from about 20 in., to 30 in. or possibly more, according to the breaking ability of the ground. There are about 12 of these enlarging holes, so that in the drift-stopes on the Osceola lode there are about 40 holes per round. But on the Kearsarge lode, owing to the greater burden that can be placed on the toe of a hole only 30 to 35 holes are required to break a drift-stope of large section.

### FOUR SET-UPS USED IN DRIFT-STOPING

The holes in the drift-stopes are drilled from four set-ups, first the cutting-in, next the turning cut, and finally the two enlarging or squaring-up set-ups. When the cut has been extended from the floor of the level to the hanging wall, the holes are drilled in rows of three with an occasional row of four if necessary in enlarging the cut, and the holes are jumped up the foot with respect to those in the row ahead. All holes are drilled from an arm, the machine being carried on the side of the post toward the roof of the stope. The column is set up about 1½ ft. from the face while the side holes are being drilled, but in the case of the last two set-ups, where the holes are placed parallel or nearly parallel with the direction of the drift-stope, the column is placed about 3 ft. back so that the long drills can be taken out of the holes without trouble.

In the drift-stopes, all holes but the last two are water holes. All the other holes put in to skim the hanging, are drilled as flat as possible and yet carry water, while the two lower holes in each row look down. The lower hole in each row draws the ground from the floor of the drift stope. The middle hole is blasted first, then the one next the hanging, while the bottom hole is fired last so as to throw out of the way the muck coming from the other holes. A burden of about 20 in. is placed on the holes, until the cut has been turned enough so that the holes can be drilled nearly parallel to the strike of the lode. After that as much burden is placed on the hole as would be in a stope. In blasting the cut pop-holes, the post is left standing and only the machine and arm taken down, but at all the other blastings the post must be taken down. Owing to the manner in which the holes are drilled in these wide drift-stopes, the muck does not get in the way of the men and they do not have to shovel much to get a set-up.

### PROGRESS MADE IN OSCEOLA DRIFTS

On the Osceola lode the men square up about nine times per month and an advance of about 48 ft. per month is averaged in the drift-stopes, while on the Kearsarge lode an advance of about 52 ft. is made in the eight cuts per month that are blasted. In these drift-stopes a machine breaks only from one-half to two-thirds what it does in stoping, so that, while it is better mining to drive these drift-stopes and combine the cutting-out stoping with the drifting in the amygdaloid mines, when things are running smoothly, the question arises, when the development work is behind the stoping and the boundary cannot be reached before stoping must begin on that level, whether it is not better policy to drive small drifts and have fewer machines on development. In the latter case the drifts can be driven faster when small.

### MOHAWK DRIFTING AND CROSSCUTTING COSTS

The cost of the drift-stoping in the Mohawk mine where these workings are driven 12x20 ft., is given in the following table:

TABLE 1. AVERAGE COST OF DRIVING A 12x20-FT. DRIFT SLOPE IN THE MOHAWK MINE, 1909 AND 1910

| | Per Ton of Rock Broken | Per Foot of Advance |
|---|---|---|
| Labor | | |
| Machine men | 37.4c | $7.11 |
| Drill boys | 1.8c. | |
| Shoveling and tramming* | 21.0c. | 4.20 |
| Supplies | 10.9c. | 1.98 |
| Totals | 71.1c. | $13.29 |

*Eleven tons per man per day at $2.30 per shift.
†Dynamite, 40W, costs 12c. per lb.

The tonnage broken per machine per two-shift day was 30.3 tons and the average wage earned per man per shift in drift-stopes during 1909 and 1910 was $2.83, while in the 9x16-ft. crosscuts the respective figures were 22.1 tons and $2.70 per shift.

TABLE 2. COST OF 9x16-FT. CROSSCUTS FROM SHAFT TO LODE, MOHAWK MINE

| | Per Ton of Rock Broken | Per Foot of Advance |
|---|---|---|
| Labor | | |
| Machine men | 49.0c. | $6.17 |
| Drill boys | 2.4c. | |
| Shoveling and tramming* | 12.0c. | 1.44 |
| Supplies | 15.7c. | 1.89 |
| Totals | 79.1c. | $9.50 |

*Approximately.

The raise-stopes in the amygdaloid mines are put up about 24 ft. long by the width of the lode wide and it takes about as many holes to break one of these raise-stopes as it does an ordinary drift-stope. However, the rate of advance in one of these raise-stopes is only about 40 ft. per month; in a drift-stope there are two or three dry holes in a round, while in the raises two-thirds of the holes are drilled dry and such a hole takes about one-third longer to drill than a wet hole. One machine is used in these raises and a center cut is drilled, that is drawn from the foot. In putting in the round the characteristic practice is followed of blasting all the holes drilled at the end of each shift.

*(To be continued)*

## Tin Production of Seward Peninsula

Although practically all the mineral production of the Seward Peninsula, Alaska, for 1911 was derived from gold placers, interest has been renewed in the tin deposits, and a production of about 100 tons of concentrates, worth about $50,000, is reported from the tin placers on Buck Creek, says the U. S. Geological Survey. Not only has dredging for placer tin been carried on, but lode-tin mines near York have been reopened under the superintendence of a competent mining engineer. It is understood that the company intends to ship the tin concentrates to Seattle, where they will be smelted.

Paul Speier, of Breslau, reports, under date June 24, (*Min. Journ.*, June 29, 1912) that prices of cadmium remain unchanged. The Upper Silesian production during the first three months of this year totaled 10,881 kg., which compares with 10,200 kg. for the corresponding period of last year.

## Thornthwaite Mine, England

LONDON CORRESPONDENCE

The Thornthwaite mine is situated in the Lake district of Cumberland, only a few miles from Keswick and two miles from Braithwaite station. This mine was sunk to a depth of 65 fathoms, and has been intermittently worked for 400 years, or before the use of gunpowder was known in mining. The shaft was sunk in the valley and levels were extended over a mile on the course of the north and south vein. The upper part of the veins on the hillsides was well prospected by means of adits. Steam and water power are used in the working of the mine. The rock is of the Skiddaw slate series. This mine is a notable proof of the romances of mining, the rich shoots being found at the time when needed most.

### LEAD AND ZINC IN QUARTZ

The machinery is worked by a small Pelton wheel about nine months of the year, and by a suction gas-producer plant (Tangye's make) three months. The shaft is on the left, and the mill on the right of the main Keswick and Cockermouth road; they are connected by a short trestle bridge, which does not materially detract from the beauty of the surroundings. The ore is brought to surface through a vertical shaft in cars of 14 cwt. capacity. The valuable minerals are lead and blende in about equal proportions, while the gangue is largely quartz.

The ore is dumped into a small storage bin, and raked from the bin on to a horizontal grizzly. The oversize is lifted by hand into a Blake crusher. All the ore is washed into a second crusher and from this crusher passes through a 2x12-ft. trommel, so arranged that the fine screen is at the feed end, and the coarse screen at the discharge end. From the trommel the ore is raised by means of a cup elevator high enough to pass through a set of Cornish rolls, 2 ft. in diameter.

From the rolls, the residues fall on to Luhrig jigs, which give entire satisfaction. In this mill there are 12 three- and four-compartment jigs. Green, Thomas and Luhrig types of jigs are used, which are equally satisfactory to the alloted work. One of the Green jigs is reserved for removing all impurities, such as the heavy sulphides of zinc, iron, etc., before the concentration can be said to be complete.

The jig tailings are pumped to a separator or classifier, and the slimes flow to Luhrig tables, where the heads, which look like pure galena, are pumped to another Luhrig table. Here the heads show two markedly distinct lines, the first being galena and the other blende. The blende contains 58% or more of zinc. The tailings from the jigs, which still carry a little lead and zinc, are conveyed to a small set of rolls and re-treated.

### WILFLEY AND BUSS TABLES USED

In the slime department there are Wilfley and Buss tables. (The first Wilfley tables in England were used here.) The slimes flow into two large concrete tanks, with four compartments in each. After settling, the water flows over the outlet, the entire width of the tanks, while subsequently the slime flows into a small compartment or tank, and from there is pumped to the tables for treatment. The refuse slimes from the tables are allowed to settle in large reservoirs.

After the slime has settled, the gravel from the jigs is trammed and discharged into catchpits of from 12 to 20 ft. in depth. It is imperative that the river from Derwentwater that flows into Lake Bessingthwaite, just below the mine, should not be polluted, or even discolored by mine water, on account of the amenitles of the district and the alleged destruction of the fish. There seems to be little evidence, however, that discoloration from impounded tailings is as injurious as represented.

This mill is old and has a capacity of four tons an hour. There is probably no mill anywhere which uses more water for concentration; the jigs for the coarse and fine, and the tables for the slimes, are practically on a level, and a strong current of water is necessary to convey the pulp from one department to another.

To obviate this difficulty, the launders were lined with glass, but it was not a success, owing to the rapid erosion of the glass by quartz gangue. Glass-lined launders should not be exposed to shocks of any kind, as the glass easily breaks; the sand insidiously gets in the crack and under the glass, raising it, thereby minimizing the efficiency of the launders. Under the most favorable circumstances, the glass-lined launders would not last more than six months. At present 4- and 6-in. drain pipes are in use and are much approved. It has been observed that when one pipe shows signs of wear, every pipe in the set does, and there is a decided saving in the matter of time and expense by replacing the whole set at one time.

The mill is to be remodeled, so as to economize in water, but there will not be much change in the jigs or tables, as they do good work, since they are well watched and are not crowded. The lead is dressed to 82%, carrying about 10 oz. silver per ton. The blende as cleaned in the jigs assays 52% zinc; the slimes assay over 58%.

In this and other old mills, no efforts were made at first to treat the slimes. They were allowed to be washed into the rivers, or into the sea. Consequently in all the old mills the slimes plants are supplemental which accounts in part for the disconnected appearance of the old mills, and for the waste of power, water and labor.

# Bolivian Tin Mining

By Mark R. Lamb*

**Bolivia is a country devoid of prospectors, and is in danger of losing its miners by migration and unsanitary living. Bolivian mines sold on past reputation. No reserves ever blocked out. Good chance there for American prospectors and investors.**

*Manager in South America for Allis-Chalmers Co., Santiago, Chile.

Tin mining in Bolivia is a business which has been too much neglected by Americans. Bolivia supplies one-quarter of the world's production, so the tin is there. The product shipped in a concentrate, which, if 70% tin, sells for $600 per ton in London.

When it is remembered that the mines now operating treat ores with 6 to 20% tin, besides silver, and besides frequently find 60% shipping ore, it is easy to understand how immense profits are made.

### Bolivian Mines Sell on Reputation not Reserves

Bolivian, English and Chilean capital predominate for several reasons. One is that it is the custom to buy tin mines on their records and not on ore blocked out; so far, the Americans who have come to the country have not done this. Another reason is that there are no prospectors in Bolivia. The ground between two producing mining districts is entirely innocent of prospect shafts and even of empty tin cans. Except that hard work is impossible on the plateau at the elevation at which most of the mines are found, prospecting in Bolivia is no more difficult than in Nevada. New mines are not being found, but neither are they being sought as they would be elsewhere.

Clear titles are not easy to obtain and frequently one hears of a series of suits brought against successful mines. However, the condition is probably not worse than in Mexico, South Africa and Australia—and not nearly so bad as in Butte. As in other countries, it is possible to buy, depending on the care exercised, either a mine or a lawsuit.

Except in the modern plants, copper and tin ores are crushed under *quimbaletes* by hand or foot power. Even with some of the companies which have hand-fed stamps and hand-discharged chilean mills, the miners working on contract to deliver concentrate, use *quimbaletes*. As will be guessed, the ore crushed in this way sometimes reached 200-lb. per shift per man. Women then wash the crushed ore by hand in tiny moss-bottomed launders, dignified by the name "square buddle." One washing is not sufficient. The heads are accumulated, washed and rewashed until the concentrate reaches the required grade. One concentrator in Huanuni who justly prides himself upon shipping nothing under 70% dries his concentrate and carefully screen-sizes it for the final purifying washing.

The concentrate is all shipped abroad, but not to the United States, though the States uses over 50% of the world's tin. The same thing occurs with Peruvian and Brazilian rubber—the American manufacturer will not buy in New York, but insists upon English brands.

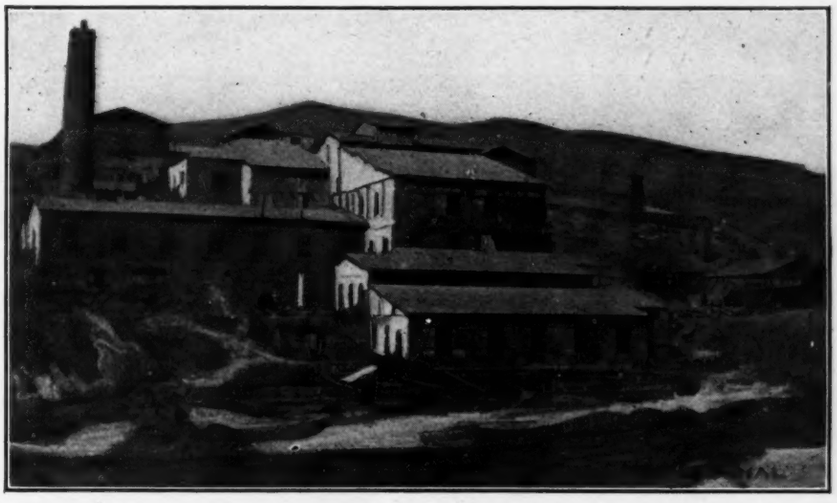
Nearly without exception, silver accompanies the tin and usually it is recovered by a chloridizing roast, and lixiviating. Sometimes copper occurs, but it is rarely saved owing to lack of facilities. Bismuth is a frequent valuable byproduct and also seriously affects the value of the concentrate when it cannot be entirely separated. When pyrite accompanies the tin it is removed by roasting the ore or the concentrate, depending upon its amount, and in the latter case a re-concentration of the concentrate is necessary.

Tin concentration should not be difficult as the specific gravity of cassiterite is high. My own opinion is that the greater part of the losses now sustained is due to lack of careful classification and regrinding. A proof that classification is faulty is the fact that mill tailing is successfully washed by hand without further grinding. A proof that grinding would decrease the loss is found in the fact that jig tailings of half-inch size are discharged which contain 2% tin. One elaborate mill was built not long ago beginning with ¾-in. jigs, where the tin occurs in the ore in particles ⅛ in. and less. Fine grinding stopped the greater part of the loss at that plant.

### Huanuni Properties Consolidated

Lately Señor Patiño has purchased what is considered the most important group of mines in Bolivia—the properties at Huanuni. For years the two important owners in this district have been in litigation. After Chilean, English and then American promoters had tried to reconcile conflicting interest and had failed, Señor Patiño bought the entire region. The purchase price was $2,000,000, payable within a short period, relatively. No formal examination was made which would have satisfied American investors, and but little ore is blocked out.

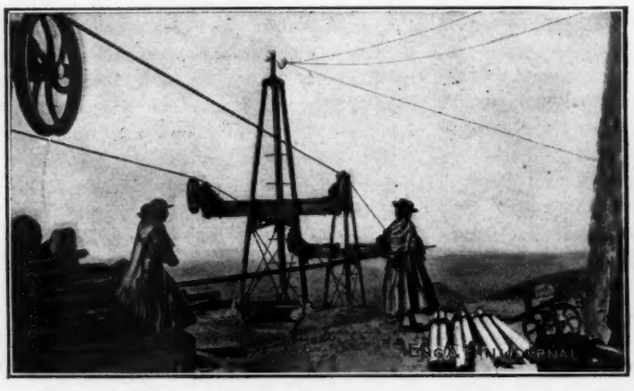
Señor Patiño is an example of a quick rise based on almost uncanny good judgment. From a modest beginning but with some backing from his intimates and those who believed in his judgment, he has in eight or 10 years attained an income reaching $10,000 daily from his mines, banks and industrial schemes. His plants under Herr Block's management are not to be criticised lightly. There is one feature of his management which could be profitably imitated in mines elsewhere. The managers, superintendents and administrators are given moderate salaries with a percentage of the profits, or a few dollars for each ton of concentrates shipped. Some of Patiño's managers are making big money under this arrangement and he is keen enough to let them continue doing it.



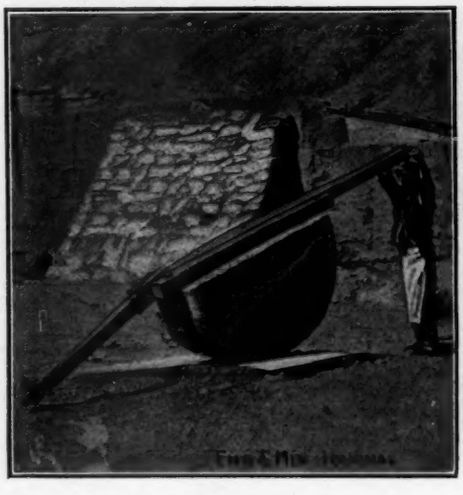
Reduction Works of the Llallagua Tin Mine, in Bolivia

For nearly two years the price of tin has been high and tin mines are not held at low prices. Nevertheless there are opportunities to buy prospects, mines, waste dumps and tailings that will pay handsome dividends.

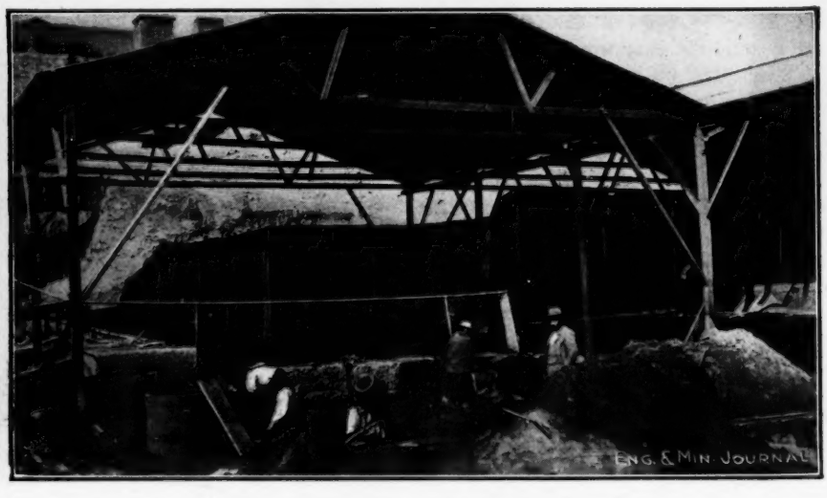
Where mines are located some distance from the railway the concentrate is shipped on llamas in 50-lb. bags. Llama transportation is cheaper than by carts since the pack animals find their own food along the way, while feeding stations must be provided for the cart mules. Carts are quicker but in the words of the Arkansas hog herder, "what is time to an Indian?"



TRANSPORTING MINE SUPPLIES IN BOLIVIA



A QUIMBALETE



HAND CONCENTRATION OF HAND-CRUSHED ORE

### INEFFICIENT RAILROADING

The Antofagasta & Bolivia Ry., Ltd., is certainly worthy of the booby prize among the world's railways. A collection of its stupid, laughable—almost incredible qualities would clog a No. 21 Gates. The La Paz paper says that 20 years ago in pre-railway days, the llama freighter took two weeks for the journey between Oruro and La Paz and was forced to make good all losses. After him came the carts which made the trip in a week and were also responsible. But now La Paz has only the railway, which frequently requires a month to deliver goods—and is not responsible for losses. There is a change of gage at Oruro, which will soon be at Uyuni. This means a transfer from narrow to broad gage, and whoever goes mining in the territory tributary to that railway system must expect and be resigned to long, unnecessary, unavoidable delays. One of my customers, by a free use of the telegraph to Antofagasta and of the cable to London, succeeded in trans-shipping one car load from narrow to broad gage in eight days, but this is unusually quick time. The Bolivian must not be blamed for this since the railroad is owned by an English company. It is not typical English railroading—it is simply the Antofagasta & Bolivia Ry. Ltd.

Fuel is the Bolivian problem. Not fuel for the household because the house is not heated and only enough llama dung is needed in the kitchen for cooking. Sometimes hydraulic power is available, in which case, whatever it costs, it is cheap in comparison with coal or oil. Usually it is necessary to use either producer-gas or oil engines. Señor Patiño has several oil engines and until tank cars are put into service he imports crude oil in barrels and tins. He is reported to have said that cologne would be cheaper.

Producer-gas engines are the common prime movers. Anthracite coal is imported from Australia and Pennsylvania. Its cost on the coast is the price at the mine plus a reasonable freight rate, but from Antofagasta it accumulates value on its way inland like a Berkshire in clover. By the time it reaches Oruro it is a precious metal and long before Uyuni it is watched like jewelry. The new Arica to La Paz railway which has just run its first train through from the coast, will shorten the haul by half and reduce the freight by more than half. The branch railway from Rio Mulatos to Potosí will be a big help to the miners at the latter place and the same comment applies to the railway to Cochabamba. It will never be possible to hire

a special train and rush a hoist from Chicago to the mine in a week as was done in the golden days of Goldfield. The usual time for shipments from Chicago will rarely be less than 45 to 60 days. This means heavy stocks of supplies and repairs and stores and even more—it means a storekeeper who can read the future.

### Bolivian Labor Conditions

Managers and men filling other responsible positions are generally foreigners. This will continue to be so, as long as the better class of Bolivian youths are educated in European countries where to work is a disgrace.

The normal Bolivian worker is a good laborer. If his government would protect him from alcohol instead of protecting the alcohol, it would be better for the country, the tin miner and the laborer. The Indian does not drink continuously but waits for a holiday, whereupon all of him gets drunk and stays so for weeks, the plant and mine shutting down meantime. One German engineer, manager of an important property, states that in 10 years there will be no laborers for his mines. Bolivia is doing much railway construction and Chile requires laborers for the nitrate fields. Both of these industries are taking laborers from the mines. The miners cannot easily be replaced by importing from other countries on account of the altitude but as soon as hand labor is replaced with air drills and labor saving machinery of other kinds, it will be possible to import Italian and Spanish workers.

The Bolivian Indian is addicted to cocaine, so at times he is stupid. He is honest and dependable, however, when trusted with a mission. He takes no care of his children and the supposedly intelligent foreigner who will need the children in 10 years more is doing nothing to help care for them. Last June, after a driving, cutting snowstorm at 14,000-ft. elevation the trail of a party of Indians crossed mine. The tiny barefoot tracks, occassionally stained red, among the larger foot prints, told the story plainer than words. In a country where it is considered womanish and even unhealthy to live in a warmed house or to dress warmly, where there are only two stoves (one is in the lake and the other is broken), and, where the native mother says "another angel to pray for me" if she loses a baby, the labor problem needs attention.

The price of tin as stated above, has been around 42c. per lb. for nearly two years. So far as the wise ones can see, there is little chance of its going lower and every chance of its going higher. The production from the Malay Straits is decreasing due to shortage of labor supply and to the fact that the tin from there is placer. Cornish production has fallen off until recently. Every war scare increases the demand for tin for preserved foods.

We have an excellent, live American minister at La Paz who is *persona grata* in Bolivia and who is working to attract real American investments to Bolivia.

The Bolivian mining laws are quite different from American—better in some respects and worse in others. From all reports, it is simply a question of keeping within the law. One American company has had difficulties, but has stuck stubbornly to the position it had taken. It is now finally reported to have won.

Tin is of course the main resource of the highlands of Bolivia. Besides this metal are silver and copper on the plateau region and rubber from the hot country in the valleys of the rivers tributary to the Amazon. As the tropical country can be reached in a few hours on horseback from La Paz, there is little doubt that a railway will shortly be built.

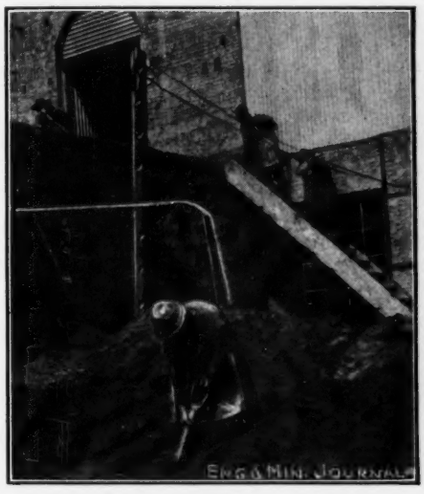
### Bolivian Mine Examinations Expensive

Recently a small American syndicate sent engineers to examine a copper property, but their whole capital did not suffice to make the examination. The right way to get into tin or copper is to establish headquarters in Oruro and patiently examine every mine and the man who offers it. Americans have the reputation of arriving today, examining the mine in a week, and then returning to the States without taking time to see other possible opportunities. It would be easier to examine all the mines of California than of Bolivia in a week.

A prospecting expedition would stand an excellent chance of success if well equipped. The members of the party would require some time to become used to the altitude and would spend considerable money at first. The opportunities for capital are numerous because there is little capital in the country.

The Corocoro copper ores of Bolivia are easily mined and concentrated. The deposits are large and the companies now operating are treating not less than 5% ore. The copper occurs native and the rock is soft. The copper ores are nearly as attractive as tin since the former are near the railways.

Political conditions in Bolivia are good and the feeling towards Americans is favorable. The Bolivian government is as stable as any other in South America. The Bolivian of the better class is an educated, traveled and polished citizen of the world. There are many opportunities in Bolivia for the man who can see them.




Women Carrying Tailings for Reconcentration

Automatic Slime Tables at a Bolivian Mine

## PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

There is a vacancy in a junior position on the editorial staff of the JOURNAL. Experience in mining is an essential qualification.

R. C. Vanderford, formerly of Spokane, Wash., is now in the Eureka district in Nevada.

H. F. Baker, secretary of the Lehigh Coal & Navigation Co., has been chosen a vice-president of the company.

Will C. Russell, manager of the Rawley mine, has returned to Bonanza, Colo., from a short trip to New York.

Richard V. Roane, of Pulaski, Va., has been appointed state mine inspector of Virginia. He is a mining engineer of long experience.

T. L. Sharp, formerly with the University of California, has been appointed professor in the University of Utah at Salt Lake City.

D. C. Jackling, of Salt Lake City, Utah, is to have supervisory charge of the operations of the Butte & Superior Mining Co., in Montana.

J. R. Kennedy, of Cobalt, Ont., is inspecting mining properties in the Manitou Lake district for a syndicate of Ottawa capitalists.

Hamlin B. Hatch, of Porcupine, Ont., has accepted a position as field man with the Canadian Mining & Exploration Co., recently organized.

O. P. Thomas, of Johnstown, Penn., has been appointed chief engineer and general manager of the Bayless Coal & Coke Co., at Oakland.

W. S. Keith, manager for the Frankmont Mining Co., has gone to Towle, Calif., for the Helester Mining Co., to superintend mill construction.

M. H. Lovemann, of Nevada, a graduate of the Columbia School of Mines, is investigating gold properties in the Manitou Lake district, Ontario.

S. H. Hamilton, of Philadelphia, is spending the month of August examining deposits of iron and copper pyrites on Notre Dame Bay, Newfoundland.

Mosher F. Pack, formerly instructor in geology in the University of Utah, has opened an office as consulting mining engineer in the Kearns Building, Salt Lake City.

J. W. Merritt, assistant in mineralogy at Northwestern University, Evanston, Ill., has been appointed instructor in geology at Dartmouth College, Hanover, New Hampshire.

E. R. Garrett, of the University of Oklahoma, and the Oklahoma Geological Survey, has been appointed assistant in mineralogy at Northwestern University, at Evanston, Illinois.

J. Frank Ritter has been appointed acting superintendent of erection at the Steelton, Penn., works of the Pennsylvania Steel Co., to succeed Frederick C. Cohen, who has resigned.

Capt. Bernier, late commander of the Canadian government steamer "Arctic," left Quebec on July 29 on the schooner "Minniemaud" for a cruise in the Arctic islands in search of gold mines.

A. R. Brown, who has been in charge of mine-rescue work at Birmingham, Ala., has been appointed assistant superintendent of coal mines of the Tennessee Coal, Iron & R.R. Co., second division.

Harold C. E. Spence, of the International Mining Syndicate, Ltd., has been spending a month in examining mining properties in Nova Scotia. He will be in Montreal and Toronto during August.

H. H. Pinckney has been appointed division coal inspector in West Virginia, in place of P. A. Grady, who has resigned to take charge of the mines of the Davy Pocahontas Coal Co., in the Pocahontas district.

Otto Wertenweiler, late constructing engineer of the Belmont mill at Tonopah, Nev., has been engaged to construct the new 300-ton mill for the Montana Tonopah Mines Co. at the Commonwealth mine at Pearse, Arizona.

Capt. William Goodman has been appointed underground superintendent of the mines of the Breitung estate, on the Marquette iron range in Michigan. He has been mining captain at the Mary Charlotte mine for several years.

F. A. Farrar, of Brainerd, Minn., is president of the newly organized Brainerd-Cuyuna Mining Co., formed to explore lands on the Cuyuna range. Henry Nelson, of Duluth, is vice-president, and Edmond Ingalls, Duluth, is secretary and treasurer.

Dorsey Hager has resigned his position in the oil department of the Southern Pacific R.R. Co., and will open an office as consulting geological engineer at Los Angeles, Calif. He is now visiting the oil fields of the San Joaquin Valley in California.

George Harris, superintendent of the McIntyre mine, Porcupine, Ont., recently sustained a severe injury to his left leg, the knee cap being broken by contact with sharp steel used in drilling. The accident occurred when he was coming up the shaft in a cage.

J. B. Hoeing, of Lexington, has been appointed state geologist of Kentucky. The governor has also appointed the following advisory board for the survey: John C. C. Mayo, Paintsville; Percy Heley, Frankfort; R. K. Vausant, Lonier; L. D. Herrington, Richmond.

Alexander N. Winchell has resigned from the United States Geological Survey in order to resume work as a consulting mining geogolist. He has recently returned to his office in Madison, Wisconsin, after spending several weeks in Nevada in connection with litigation regarding the ownership of the ore deposits of the National Mine in that State.

C. M. Eye, who recently returned to the United States after seven years spent in the Philippines, has been appointed manager of the Concheño property, in the Rayon district, Chihuahua, Mexico, owned by the Corrigan-McKinney Co., Cleveland, Ohio. Until regular mail service is reëstablished in Mexico, his address will be Roberts-Banner Building, El Paso, Texas.

W. B. Pattison has been appointed superintendent of the mines of the Breitung estate on the Marquette iron range, succeeding Capt. Joseph Hodgson, who resigned to accept a position in Arizona. Capt. Samuel Jewell has been named as assistant to the superintendent. He has been connected with the Oliver Iron Mining Co. as mining superintendent for several years. He will have charge of all underground work.

Leggett & Hellmann announce the dissolution of their partnership as a result of Mr. Leggett's acceptance of the position of consulting engineer to the mining department of the American Smelting & Refining Co. Thomas H. Leggett's address will henceforth be 165 Broadway, while Fred. Hellman will remain in the present offices at 60 Broadway, New York, and continue the business in his own name.

The Oliver Iron Mining Co. has created a new office to be known as mine-rescue engineer, and has appointed to the position Charles H. Hawes, of Duluth, late in the service of the government. The duties of the office consist in maintaining a general supervision over rescue stations at all of the company mines in Minnesota and Michigan; inspection of equipment such as oxygen helmets, fire extinguishers, etc.; and the conducting of demonstrations.

## OBITUARY

George L. Jones died at Bloomfield, N. J., Aug. 3, aged 59 years. He had been manager of the Keystone Coal Co. for over 25 years.

## Societies and Technical Schools

*American Geographical Society*—W. J. Olcott, president of the Oliver Iron Mining Co., Duluth, is in charge of arranging for the visit to the Mesabi range of 70 members and guests of the American Geographical Society this month. The party comprises a number of distinguished scientists from 16 different countries, Russia, Servia, Spain, Sweden, Norway, Switzerland, Germany, Austria, Denmark, Belgium, France, England, Portugal, Hungary, Italy and the Neitherlands. The tour is in celebration of the sixtieth anniversity of the American Geographical Society.

# Editorial Correspondence

**From our Representatives at Important Mining Centers**

## San Francisco

*Aug.* 2—Production of structural materials in California in 1911 as shown by the report of the state mineralogist just issued, amounted in value to $17,194,057, an increase over 1910 of $1,820,589. The principal increase was in cement and crushed stone, due to activity in the construction of concrete buildings, road work, breakwater construction and similar building work. The cement production amounted to 6,371,369 bbl. valued at $9,085,625; crushed rock totaled 6,487,223 tons, valued at $3,610,357. The material having the next largest value was brick, $2,638,121. There was a decrease in the production of brick as compared with 1910, due probably to the substitution of concrete in construction work, although in some instances the decrease was due to the lower price, which was 7% lower than in 1910. The price of lime also was about 7% lower than in 1910, and there was a decrease in the production due partially to the curtailment in the production of copper and the consequent lessened demand for limestone for fluxing. The production of marble did not vary much from the production of 1910. Paving blocks were about the same in amount of production, but a little higher in price. Pottery clay production fell off materially, though the indications from the activity in the establishment of new works are that there will be an increase for 1912. In the list of structural-materials production the report names 44 of the 56 counties. Los Angeles County was the largest producer, with a total value of $2,040,314. The figures on production of metals and minerals and petroleum are in preparation by the State Mining Bureau, and will be made public as soon as completed.

## Denver

*Aug.* 2—On Dec. 4, 1912, Albert Thompson, receiver for the Red Mountain Railroad, Mining & Smelting Co., will sell in Ouray, for the highest sum obtainable in cash all the real and personal property of this corporation consisting of about 70 mining claims, most of them in the Red Mountain district in the vicinity of Ironton in Ouray County, 89,000 shares in the Silverton Smelting Co., 100,000 shares of the capital stock and five hundred $1000 bonds of the Silverton Railway Co.; and a claim against that railway company for $58,000, and other property. William Chalfant, Jr., is the plaintiff, and the defendant company is the creation of George Crawford. He and O. P. Posey were the original promoters of the rich Yankee Girl, Robinson and other mines at Red Mountain, which with the drop in silver of 1893 were closed. About seven or eight years ago they were again promoted by the same George Crawford, whose later operations have been no more successful.

A rather severe blow to the mining industry is the closing of the 6000-acre Castle Creek gold placer in the Granite district, an injunction having been issued by the courts preventing dumping of débris into the Arkansas River. For several years the towns along this river have been trying to put a stop to this pollution and the litigation has lately been decided in their favor. It is said, however, that the property could be worked by dredges.

## Butte

*July* 31—A referendum vote of the members of the mill and smeltermen's union of Anaconda, will shortly be taken to decide upon the new wage scale offered by the Anaconda Copper Mining Co. The union asked for an increase of 25c. per day while copper is above 15c. and below 17c. per lb., and of 50c. per day when copper is 17c. per lb. or more. After a conference held in Butte between a committee from the union, and officers of the company, the request was refused, but the following offer was submitted: All men within the jurisdiction of the union will receive an increase of 25c. per day above the wages paid in June 1912, as long as the average monthly price of electrolytic copper is 15c. per lb. or more, and when the price is less than 15c. per lb. the wage rate will be the same as that in force during June, 1912, this to be conditional upon the signing of a contract for not less than three years from date of its execution. Should an employee for any reason terminate his employment before the end of the month, the rate of wage settlement would be as follows: Settlement made up to the middle of the month would be rated upon the average price of electrolytic copper during the previous month, and the rate of settlement for any part of the month after the 15th day would be based upon the average price of electrolytic copper for the first half of the month, including the whole time of employment during the month.

## Salt Lake City

*Aug.* 1—The branch line from St. John on the Salt Lake route to Ophir in Tooele County, 9½ miles long has been completed, and daily freight and passenger service will be maintained. The better transportation facilities are a great importance to the mines of the district, among which are the Ophir Hill, Cliff and Lion Hill.

A meeting in the interest of the metal mining industry of the state will be held at the Commercial Club of Salt Lake City, Aug. 2, and the committee on mines and mining of that institution has extended an invitation to all to be present who are directly or indirectly interested in mining. E. L. Wolcutt, assistant secretary of the American Mining Congress, is to be present at the meeting. Plans will be formulated for such remedial legislation as may appear to be best for the metal mining industry, especially in regard to the mineral patent laws, as interpreted by the Department of the Interior.

## Kingman, Ariz.

*Aug.* 2—The heaviest assessments levied in Mohave County as the result of the tax commission determining the rate according to the production are the Tom Reed mine, approximately $875,000, the Gold Road $700,000 and the Golconda $60,000. The total tax roll this year will be about $7,000,000, which is nearly $5,000,000 more than last year's roll. Of this amount, about 30% is the assessment of the mines of the county, 40% is on the property of the Santa Fé R.R. and the remainder on other property not included under these two headings. The Tom Reed and Gold Road mines were assessed on a basis of their total bullion production and the improvements on the properties. In the case of the Golconda, which is a base metal mine, the rating was calculated on the value of the improvements and half of the bullion production. D. R. Muir, of the Gold Road company, Charles Grimes and S. S. Jones, of the Tom Reed, John Boyle, of the Union Basin Mining Co., which operates the Golconda mine, and Supervisor J. S. Withers met the state tax commissioners at Phoenix for the purpose of reconsidering the assessments levied against the companies mentioned. The commission deferred action on the cases.

It is reported that a sufficient number of signatures have been obtained to the petition seeking the recall of the miner's

lien law to have it placed upon the ballot for decision by the voters of the state. As far as can be judged from the popular expression of feeling against the measure in this county, it will be overwhelmingly recalled.

### Negaunee, Mich.

*Aug.* 2—On the Swanzy range, south of Negaunee, the Cleveland-Cliffs Iron Co. is shipping ore from the Stephenson and Austin mines, its other properties in that district being idle. Two steam shovels are kept busy shipping stockpiles, and much ore has been forwarded from the big stockpile at the Princeton mine, which contains several hundred thousand tons. In addition to these mines, the Cleveland-Cliffs Iron Co. has five concrete shafts sunk in the vein in this district with but little drifting completed; these shafts have been allowed to fill with water until such time as the ore will be needed. At the Smith or Gwinn shaft a little drifting had been done, and when the work was temporarily abandoned the drifts were walled up near the shaft to facilitate progress when it is desired to unwater the mine. The Kidder or Jopling shaft and the Northwestern or Francis shaft are also full of water. At Rice Lake, on the Southeastern end of the range, work has been stopped at the Mackinaw and Gardner shafts; these shafts were sunk a few feet into vein and sealed.

At Iron River, when the C. & N. W. Ry. desired to build a new railroad station to serve Iron River and Stambaugh, the owners of the proposed site decided to sink a diamond-drill hole on the chance of there being ore beneath. It is now announced that the drill is in commercial ore and that the railroad station will have to be built elsewhere. John Sipchen and associates are owners of the tract of land which is situated in the eastern outskirts of the city of Iron River.

### Calumet, Mich.

*Aug.* 2—A drilling contest is to be held at Calumet, Mich., on Aug. 17. The contest will be in the nature of a rigging-up contest and will be in two classes; a two-man team using a 3-B Rand drill and the other one-man with C-113 butterfly drills. The conditions are that each team or contestant is to carry the outfit 10 ft., rig up, turn on full air, run for two minutes and change steel. Time being taken from the start to the time the steel is changed. Each operating mine in the copper country will be allowed one entry for each event. There are to be three prizes for each class, viz.: $100, $50 and $25. A special contest is also to be held between the hammer-and-drill team winning the prize at the Calumet & Hecla miners' picnic, which is to be held Aug. 10, and one man with an Ingersoll-Rand type drill to be selected by Richard Knight, representative of the Ingersoll-Rand Company.

### Webb City, Mo.

*Aug.* 2—An employment bureau has been opened by the mine operators of Webb City, with headquarters in Room 21 of the Wagner Building. Shovelers, engineers, ground bosses and other laborers may register and will be placed without cost, the only restriction being that nothing but American labor will be considered. Negroes and non-English-speaking men are barred.

Wages are being increased, due to the high price of jack. Machinemen and helpers are receiving a raise of 25c. per day, while shovelers are being paid from ½c. to 1c. more per can. Some of the companies gave the increase voluntarily, but the rest are being forced into line by the prospect of a strike. In addition to the raise, several companies pay a bonus. In the case of the shovelers this amounts to 25c. per shift, providing they work six shifts per week. Bonus for the machinemen and other employees is calculated on amount and cost of work done.

### Albuquerque, N. M.

*Aug.* 2—The public does not fully realize the magnitude of the mining industry of southern New Mexico. The Chino Copper Co. now has one of the largest and best equipped plants in the West, and Santa Rita and Hurley have taken their places among the most important centers in this district. Activity and output in the Mogollon district are increasing steadily. The camp of Kelly, in the Magdalena zinc field is slowly, but surely, becoming one of the large low-grade mining fields of the Rocky Mountain region. This in connection with the resumption by the Santa Fé Gold & Copper Co. at San Pedro and other developments demonstrate that following statehood the mining industry is showing the greatest awakening for many years.

### Toronto

*Aug.* 3—An important decision affecting the rights of land owners to natural gas in the oil regions of western Ontario has been given by the British Privy Council in the test case of Farquharson *vs.* the Canada Land Co. The lands in Essex County and adjoining districts were largely purchased by the original settlers from the Canada Land Co., and the deeds reserved to the company "all mines and quarries of metals and minerals and all springs of oil." The oil and natural gas rights were later sold to other companies, and their operations interfered greatly with the owners of the surface rights. The point at issue in the action was whether gas was included under the term "mines and minerals." The court of first instance decided in favor of the plaintiff, holding that gas was not a mineral, and this decision was confirmed by the supreme court. A final appeal was taken to the Imperial Privy Council which has dismissed the appeal and upheld the original decision.

The Ontario government has passed an order-in-council opening to prospectors a strip of land one-half mile wide on each side of the Transcontinental Ry. in northern Ontario, which was withdrawn in 1909 from prospectors.

### Cobalt

*Aug.* 2—Twelve miles of roadbed on the Elk Lake branch of the Timiskaming & Northern Ontario Ry. is ready for the steel and it is expected that the commission will start laying it within two weeks. This stretch reaches to the Jean Baptiste River where the work will be delayed until the bridge is erected. When this is completed the roadbed to the Montreal River, 12 miles further, will be ready for the steel. Another bridge over the Montreal River will be necessary, and then there is another stretch of seven miles to the town of Elk Lake. It is expected that the road will be completed and service be commenced in December. The completion of this line will benefit the Gowganda mines of which at present there are three regular shippers. A healthy interest is being developed in the country, which is now in better condition than it has been for some time.

### Porcupine

*Aug.* 3—The managers of several Porcupine mines recently agreed upon a uniform scale of wages to conform to the scale in use at the Dome and Hollinger. They have now received notice that the members of the miners' union was applying to the Department of Labor for the appointment of a conciliation board to settle matters in dispute between the miners and the managers. The question at issue is the new wage scale which comes into effect Sept. 1; this causes a reduction in many departments, but still is the same as that in use at the largest mines in the district.

### Nelson, B. C.

*Aug.* 1—The California group, a half-mile south of Nelson, has been bonded to Montana men. The property was formerly owned by McKenzie & Mann and has had a large amount of work done on it. The ore carries gold principally, but also some silver and galena. The new owners intend to push development and eight men are at work. This force will be increased when necessary machinery arrives. Until then the ore will be shipped to the Greenwood smeltery. The Highland mine, at Ainsworth, is installing a new aërial tram from the No. 1 mine to the concentrator. The Nine-mile Development Syndicate, that owns good-sized deposits of silver-lead ore, on Midge Creek, is doing extensive development work.

# The Mining News

**The Current History of Mining**

## Alabama

James Bowron, president of the Southern Iron & Steel Co., has been appointed receiver of that company, on the petition of attorneys representing the company and creditors in the Federal court at Birmingham, Ala. Mr. Bowron has been at the head of the company for two years. It is announced that there will be no interference with operations of the plants of the company and the steps taken looking to the reorganization of the company will not be interfered with.

The receivers of the Alabama Consolidated Coal & Iron Co. are still operating one furnace together with coal and ore mines, coke ovens and limestone quarries to furnish the raw material. Efforts are being made to finance this company, with prospects of success.

## Alaska

Considerable activity is reported in the Nizina district, near the inland terminus of the Copper River & Northwestern Ry. The railway contributes largely to the increased development, making it possible to get in supplies and machinery.

Frank A. Iverson of the Bonanza Gold Mining Co., who recently made a strike on his property at Mile 192 near the railroad, is now ready to purchase a 5-stamp mill and material for a 1275-ft. tram.

*Erickson*—At this Glacier Creek mine a tunnel has been driven 160 ft. in decomposed porphyry in which native copper occurs. The tunnel is being driven toward a well-defined vein which it will probably cut within 40 feet.

*United Copper Exploration Co.*—This company claims to have a large reserve of copper ore developed by drifts and crosscuts.

*Kruhm*—At this property on Dan Creek a tunnel is being driven toward a dike that contains antimony minerals and gold. Several small lots of high-grade ore have been shipped to the Tacoma smeltery.

*Alaska-Gastineau Mining Co.*—Hayden, Stone & Co. have secured a large low-grade gold property at Juneau, which is a consolidation of three groups, the Alaska-Perseverance, Oxford and Sheep Creek. The company is capitalized with $3,500,000 bonds and $12,000,000 stock. The property was recently examined by D. C. Jackling and A. F. Holden. It is reported that about $5,000,000 will be expended immediately for extensive development of the property and the erection of a mill of 6000 tons daily capacity. The claim is made that 15,000,000 tons of ore is actually developed above the tunnel level, which figure does not include any of the partially developed or possible ore below the tunnel level. The securities owned by the syndicate will be placed with a new company to be known as the Alaska Gold Mines Co. It is intimated that a profit of $4,500,000 can be made with a 6000-ton mill, and it is the intention of the management to double the milling capacity a year or two after the installation of the first unit.

## Arizona

### Gila County

*Inspiration Consolidated*—The main west working shaft is more than 200 ft. deep and is being sunk at the rate of 5 ft. per day. During July, it was sunk 164 ft., which is said to be the record for the state for a three-compartment shaft. Sinking of the Scorpion shaft has been discontinued at a depth of 545 ft., and that of Live Oak No. 2 at a depth of 1181 ft.; a pumping station is being cut at the 1160-ft. level. Live Oak No. 1 shaft is being sunk and is 496 ft. deep. Underground development work is proceeding at the rate of about 4200 ft. per month. The new dormitory and mess house for the members of the staff are nearing completion and a new office building will be erected near the mill site. H. Kenyon Burch is at the mine.

*Superior & Boston*—A new stope is being opened on the sixth level. Two stopes are being worked on the Limestone vein, one on the second, and one on the third level. On the 12 level, the east crosscut is in schist 500 ft. from the shaft and the crosscut being driven south toward the Limestone vein is in 410 ft. in diabase.

*Iron Cap*—At the Copper Hill mine, drifting is being done on the 650-ft. level, from the Williams shaft, on what is believed to be a continuation of the Old Dominion vein. The west drift is in 310 ft. and the east drift 95 ft. On the 800-ft. level the drift is being continued west and is 110 ft. in.

*Sleeping Beauty*—Jones & Danum have leased the claims of the Sleeping Beauty Copper Co. in the Sleeping Beauty Mountains, seven miles northwest of Globe. There are 20 claims in the group and the ore contains gold, silver and copper.

### Graham County

*Arizona Copper Co.*—For the six months ended Mar. 31, 1912, the profit from copper, stores and rents was £170,043. The deductions against this profit amounted to £19,447; revenue from holdings in other companies was £36,351. After deducting interest on debentures and dividends £164,180 surplus remained.

### Mohave County

*Mocking Bird*—The mill is practically completed and a trial run will soon be made. A. F. Muter will be in charge of the cyanide plant.

*Banner*—It is reported that the lessees working over the dumps of this Stockton Hill mine, have about a carload each of lead and zinc ore ready for shipment to the smelters.

*Boundary Cone*—R. C. Jacobson has just completed a survey of the mine, the primary purpose of which is to provide for a raise from the 450-ft. level to surface. This raise is necessitated by a provision of the new mining code which requires two outlets to surface in a mine having a shaft over 100 ft. deep with 200 ft. or more of drifts. It is expected that the new raise will be used as a working shaft.

*Gold Road*—Six carloads of lumber for this mine have been received at Kingman. This is a portion of the amount required for the addition to the mill. It is stated that this addition will be completed and ready for operation before Jan. 1, 1913, and that the mill at that time will have more than twice its present capacity.

*Mitchell*—It is reported that ore, worth several thousand dollars per ton, has been found on the 350-ft. level. The oreshoot is the full width of the drift. Milling and some high-grade ore has been found wherever the vein has been cut from the 100-ft. level down to the present depth. S. R. Porter, manager.

*De la Fontaine*—A carload of lead ore is being mined for shipment. The ore is rich in lead, contains some silver and a little gold.

*Tom Reed*—An extra cleanup at the mill netted the company bullion worth $75,000. This makes the total shipments for July about $154,000. Charles Grimes, president of the company, was a recent visitor to Kingman.

*Arizona-Southwestern Copper Co.*—The new seven-ton Saurer motor truck has been received and has been put in commission hauling supplies for the new

mill from Yucca to Copperville. J. H. Hoffman, secretary of the company, is at the mine.

PINAL COUNTY

*Magma*—This company, at Superior, has just finished the installation of the last two boilers in the power plant and as soon as the compressor is erected, operations will be conducted on a more extensive scale than formerly.

*American Smelting & Refining Co.*—This company is repairing the power plant at the Lake Superior & Arizona mine at Superior. Unwatering and examination of the mine will be started soon.

*Calumet & Arizona*—It is reported that this company has taken an option on the Cobre-Verde group of 81 claims at Superior one mile south of the Magma mine, the option calling for a total payment of $500,000.

*Ray Consolidated*—Five sections of the mill are now in operation, and 4500 tons of ore are being milled daily; the sixth section will soon be placed in commission.

## California

AMADOR COUNTY

*Hardenberg*—Crosscutting from the 1000-ft. level of the new vertical shaft is in progress. It is expected to cut the vein at about 200 ft. from the shaft.

*Lincoln*—The drift at the 1950-ft. level is being advanced rapidly toward the Wildman vein, making 94 ft. in the week ended July 13. This drift will cut the Wildman several hundred feet below the lowest Wildman workings. Andrew Noce, of Sutter Creek, superintendent.

*Newman*—The mine at West Point has been bonded and development is in progress. A compressor and machine drill have been installed.

*Defender*—This mine near West Point is being unwatered with a steam pump preparatory to resuming development.

*Lockwood*—A new hoist has been installed, and the 325-ft. shaft is being unwatered.

*Billy Williams*—Prospecting and preparation for placing the stamp mill in commission again are in progress. T. S. Jenkins of West Point, owner.

CALAVERAS COUNTY

*Comet*—A strike of high-grade ore is reported at this mine at Railroad Flat.

*Dolling*—A vein of good ore is reported in the development of the drift of the 400-ft. level. Good ore has also been disclosed on the 800-ft. level. The mill was closed down in the spring and development undertaken at and below the 400-ft. level. The prospects now are that the mill can be started with the prospect of a large supply of ore blocked out and ready for extraction. D. G. Overall, of Angels Camp, superintendent.

ELDORADO COUNTY

*Karpendar*—The shaft has been deepened to 160 ft. and good pay gravel disclosed. E. N. Walker, Smith Flat, superindent.

*Chile Ravine*—This gravel mine at Placerville has been sold by A. W. Tennant to the Atwood Mines Syndicate, of San Francisco; 20 men will be employed. W. A. Sanders, superintendent.

HUMBOLDT COUNTY

*Coronade Oro*—Dr. F. H. Ottmer and others, of Eureka, have filed on 15,000 in. of water in Cedar Creek to be used in operating two giants to be installed at this hydraulic mine. The gravel has been developed by tunnels. Water has also been secured from Hawkins Creek.

*Horse Mountain Copper Mining Co.*—Five additional claims have been purchased. A deposit of copper-bearing sulphides was recently disclosed.

INYO COUNTY

*Skidoo Mines Co.*—During the month of June, in which ten days were lost, 1186 tons of ore were milled from which was produced; amalgamation bullion, $11,349; cyanide bullion, $5604, making total receipts of $16,953. The costs were:—For development, $1399; for operation $7,819; a total of $9218, leaving net profits for the month of $7734.

*Loretta*—A contract has been made with the Nevada-California Power Co. for the construction of an electric power line from the Goldfield wires at Gilbert Hill to the mine which is on the west side of Eureka Valley, 18 miles from the summit of the White mountains. The foot wall has recently been cut in the vertical shaft at 865 ft. While awaiting the installation of a new hoist prospecting is being done. A crosscut has been driven 110 ft. without finding the hanging wall. It is the purpose to deepen deposits of solid sulphide ore will be en solid deposits of sulphide ore will be encountered at that depth. The ore so far developed has shown some rich sulphides in small bunches carrying gold and copper. The mine was discovered by William Eva in 1879; was acquired by the Schwab interests and the Loretta company was organized in 1896. Should development warrant it is the intention to build a smeltery and construct a railroad from the mine to Coaldale, a distance of about 60 miles.

MODOC COUNTY

*Fort Bidwell Consolidated*—High-grade ore is reported to have been disclosed at 200 ft. depth. The 10-stamp mill is again in commission. At a recent meeting of the stockholders the management of the company was taken over by a new board of directors. A. J. Cummings, general manager.

SIERRA COUNTY

*Brown Bear*—At this gravel mine, near Goodyear Bar, a steam plant for pumping and hoisting has just been installed. J. G. Jackson, of Oakland, is operating under bond.

*Kate Hardy*—New machinery of a heavier type for sinking and hoisting by electric power is being installed at this Forest mine. W. M. Beggs, of San Jose, and associates are owners.

*Bellevue*—At this La Porte mine gravel rich in coarse gold is being taken out. A large force of men is at work extending a wagon road to the mine from Little Grass Valley.

*Sierra del Oro*—At this old property, once known as the Ironsides, at the head of Jim Crow Cañon, southeast of Downieville, a rich strike has just been made, more than $3000 having been hand mortared from less than a wheelbarrow load of quartz, and $10,000 having been obtained by amalgamation from less than two tons of ore milled at Alleghany. A large percentage of the gold is in very rich arsenical sulphurets. A tunnel has developed 100 ft. of payshoot, with 60 ft. of backs in the face. The vein averages four feet in width. This rich ore was taken from a stringer near its contact with the main vein. The formation is slate and porphyry. The property is owned by District Attorney W. I. Redding and John Mayer, of Downieville, and Hugh McCormick, of Forest.

*Keystone*—At this old Sierra City mine a vein of high-grade ore has just been struck. The drift has been run on this shoot over 30 ft., with 1200 ft. of backs. S. W. Van Syckle, of Newark, N. J., is operating under bond.

## Colorado

BOULDER COUNTY

*Boulder Tungsten Production Co.*—This company is installing an electric hoist and pumping plant preparatory to sinking a shaft to a depth of 500 ft. Systematic prospecting has been done which has developed several large tungsten veins. The company is considering the erection of a concentrating mill in the near future. The property is at Nederland near the dam of the Central Colorado Power Co. J. G. Clark, of Boulder, manager.

*Colorado Tungsten Mines Co.*—This company at Carrie Nation Park, has developed a new vein. During the last six months 1200 ft. of drifts and crosscuts have been driven with satisfactory results. The mill is running full time making a high recovery.

*Silliman & Lively*—These men, lessees on the Argo at Jamestown, have developed a wide silver-lead vein upon which they have driven 60 ft. The property is developed by tunnel and all work is done by hand. The lessees are shipping a

car of ore per week. The property is owned by McIntosh & Clemens of Boulder.

CLEAR CREEK AND GILPIN COUNTIES

*American*—It is reported that money has been raised to resume the development of this property on Democrat mountain, where five men are now employed on preliminary work. Plans include driving a new main working tunnel and construction of four buildings, bunkhouse, blacksmith shop, storehouse and manager's cottage.

*Portland*—Development of this property on Democrat mountain has been resumed. The crosscut tunnel will be advanced to intersect the Portland vein, upon which drifts will be driven. Arthur Roberts, manager.

*Centennial*—This mine in Hukill Gulch is being developed by lessees. The shaft is being sunk and is now 16 ft. below the tunnel level. The vein is 4 ft. wide and contains a band of rich ore. A small shipment has just been made.

SAN JUAN DISTRICT

Control of the Telluride Power Co., capitalized at $20,000,000, and owning six large hydro-electric power plants in Colorado and Utah, has passed into the hands of New York, Boston, and Cleveland capitalists. J. R. Nutt of Cleveland, acting for the Eastern men, bought $5,000,000 worth of the company's stock. It was announced that the bonds would be taken over on Oct. 1. The stock was sold at 25c. per share.

*Morning Star*—Development and operation will soon be resumed. The water-power compressor plant, has been repaired and placed in working order. A new boarding house will be built at the portal of the Sunshine tunnel. The plans are to advance this tunnel 800 ft. W. R. Vanderveer, manager.

*San Bernardo*—This property near Ophir Loop is being examined and milling tests are being made to determine the advisability of reconstructing the mill and operating the mine.

*Lewis*—The mine and mill are in operation. The mill will treat 60 tons of silver-lead ore per day throughout the remainder of the open season. Concentration is about 5:1. The mill is at an altitude of about 12,000 ft., and on account of the heavy snowfall during the severe winters the mill can operate only during summer and autumn. Development work is continued during the winter. The main shaft is 500 ft. deep.

*Silver Bell*—The breast of the crosscut is now 1800 ft. from the portal. The tunnel is 6x7 ft. in the clear. Two blind veins have been cut, one of which is 13 ft. wide. The pay ore contains copper sulphides and lead, with gold and silver. The crosscut is being extended at the rate of 4 ft. per shift to cut the Ida vein. The equipment includes an Ingersoll compressor and air drills.

SAGUACHE COUNTY

*Rawley Mining Co.*—During July, the development and drainage tunnel at Bonanza was advanced 555 ft. On Aug. 1, the bore was in 5239 ft. The advance of 555 ft. in July was made in 26 days' actual working time in the heading, five days having been lost during the Independence Day period and in timbering. It is anticipated that the remaining 1000 ft. of the proposed bore will be completed within 60 days; 50 men are now employed.

TELLER COUNTY—CRIPPLE CREEK

*Portland*—Shaft No. 2 is now 88 ft. below the floor of the 1500-ft. level and it is expected to encounter water at about the 1600-ft. level. Laterals will then be driven to open the ore now being stoped on the 1500 level.

*Vindicator*—On the 1500 level there are four machines working in ore and Superintendent Nagel reports that five veins opened at this depth are as good as found above. All the lessees, as well as those on the Hull City, have been successful during the last two months.

*Free Coinage Estate*—From the fourth level of the Pinto shaft 2- to 3-oz. ore has been sent out by Walker & Co., lessees.

*Dead Pine*—It is reported that the output from this and the Crown Point mine by lessees Duncan & Carnduff will reach about one carload per day of rich ore, and that this ore has been opened for a length of 100 ft. on three levels.

## Idaho

IDAHO COUNTY

*Parr*—A rich strike was recently made on this property, which led to the bonding of the group. A shaft has been sunk 65 ft., from which drifting has been started.

*Jumbo*—This property will be running at full capacity in about 10 days. The mill has recently been overhauled and put into good shape.

*Revenue*—A strike of high-grade silver ore is reported from this property.

*Brown Bear*—During the last year much development work has been done on this property; a large quantity of ore being opened up. The owners are now contemplating the erection of a 10-stamp mill before the beginning of winter.

*Gold Point*—The mine and mill recently acquired by W. W. Seaver and associates of Grangeville are being put in running condition. The properties are under the management of A. L. Flagg, of Spokane.

*South Fork*—The mine and mill are being operated steadily. The company has begun to ship concentrates to the Tacoma smeltery.

## Kansas

CRAWFORD AND CHEROKEE COUNTIES

The litigation over the Katy and the White Eagle properties, near Baxter, has been settled and both properties are being reopened under one management.

*Pittsburg Zinc Co.*—At the smeltery at Pittsburg, 65 men are on strike for 25c. more per day. Four blocks of retorts are now on a dead fire and the company states that it will pull the fires rather than increase wages, as the margin between the price of ore and the price of spelter is too small to permit it. This company has been taking 350,000 lb. of "jack" per week from the Joplin district, and extensive improvements, including the installation of a mechanical roaster, have been made lately.

## Louisiana

*Gulf Refining Co.*—A well has been brought in by this company about 14 miles northeast of Mansfield. The Standard Oil Co. has brought suit to enjoin the Gulf company from sinking any wells on its land or lands upon which it holds mineral leases; individuals have also filed a suit against the same defendant enjoining it from tresspassing on their land.

*Big Ten Oil Co.*—This company brought in a gusher in the Vincent oil field, west of the city of Vincent, which is now producing between 800 and 1200 bbl. per day. The flow was reached at a depth of more than 2100 feet.

## Maryland

It is reported that the Pittsburgh Steel Co. has secured extensive limestone deposits near Williamsburg, Md., just off the main line of the new Western Maryland extension, between Cumberland, Md. and Connellsville, Penn. It is planned to have a spur of this line built through the property, which the company secured for the purpose of supplying its future blast furnace requirements at Monesson, Penn.

## Michigan

COPPER

*Mass Consolidated*—Shipments are now being made at the rate of about 450 tons per day. The trestle on the Mineral Range R.R., which was expected to be ready about a week ago, has prevented increased shipments. It is now stated by railroad officials that this trestle will be in order within another week.

*Osceola*—Water in the No. 4 North Kearsarge shaft has been lowered to about 30 ft. above the 15th level. Drifting on the 10th and 12th levels north, which are now in close to the Allouez boundary, has been stopped, because of

the possibility of running into quicksand. Shipments have recently declined on account of water troubles, and are now about 300 tons daily.

*Isle Royale*—A new test pipe is being sunk at the site where it is proposed to sink the new No. 7 Isle Royale shaft. The overburden is 120 ft. deep.

*Allouez*—Shipments from No. 2 shaft now exceed 700 tons daily. Sinking has been stopped temporarily, but will be resumed in short order; the shaft is now between the 21 and 22 levels. Sinking has been resumed at No. 1 shaft; the new rock-house at shaft No. 2 is practically completed.

### Iron

Lake shipments of iron ore continue large, and for 1912 will establish a new record.

*Stephenson Charcoal Iron Co.*—The charcoal iron furnace of this recently organized company was recently blown in at Wells.

*Negaunee*—Contracts have been let to Lipsett & Sinclair, of Marquette, for the erection of a combination shop building, 33x134 ft., divided into blacksmith, machine and carpenter shops; and for the erection of a warehouse, 30x56 ft. The buildings will be of white brick and steel, and will be erected near the mouth of a tunnel leading to the shaft, through which electric-tram cars will run to convey timber, tools and supplies.

## Montana

### Butte District

*Butte & Superior*—It is stated that D. C. Jackling, has been appointed manager of this company, and that the stockholders may be given an opportunity to subscribe to stock of a new company, which will be formed to take over numerous claims nearby and adjoining the Butte & Superior property.

*Butte & London*—It is understood that engineers are now at work on a report on the property and that it will include the results of the crosscut which is now being driven by the Anaconda eastward to the Green Leaf and Anaconda property, east of the Butte & London, which has been partially developed by a 1000-ft. shaft. The crosscut is said to pass directly through the Butte & London ground. The report will be forwarded to Eastern men who are negotiating for control of the mine.

*Anaconda*—This mine, which has been closed since September, 1908, on account of an old fire, has again been reopened. During the long shutdown the fire zone has been thoroughly walled in with cement and bulkheads. The entire shaft from the surface to the 2400-ft. level has been retimbered. Some portions of the mine have been worked through the St. Lawrence.

*Hidden Lake*—Negotiations for the sale of this group of claims in the Georgetown mining district have been made, and recently representatives of Eastern men have been making an inspection of the property. The prospective purchasers secured a short-time option.

### Madison County

*Montana-Illinois* — The Montana-Illinois Copper Mining Co. recently held its annual meeting and elected as a board of directors Del Clark, B. W. Wilson, J. W. Brown, W. G. McCornack, J. C. Oberon, L. H. Stanhope, and Alexander Mackel. The company owns 11 patented claims 20 miles south of Jefferson Island in the Tobacco Root mountains. Development work is being done with a force of 18 men in the Bismarck and First Extension claims, and a 100-ton mill now in the course of erection will be completed in about two months. A good grade of copper ore has been discovered in the end of the lower tunnel in the Bismarck, and a motor traction engine has been acquired to haul the concentrates from the mill to the railroad at Jefferson Island. The mill will be operated by water power, and machine drills are now in use.

## Nevada

### Churchill County

*Nevada Hills*—The report of the company for the month of June states that 3450 tons of ore was milled of the gross average value of $34.48 per ton; net profit, $71,102, or $20.61 per ton. Operating costs were reduced from $11.06 per ton in May to $9.70 per ton. From the net profits the sum of $8000 was deducted for depreciation of buildings and equipment. The total recovery was 87.9 per cent.

### Clark County

*Bullion*—Tursick & Munzeberg, lessees of this property, recently shipped two cars of lead ore to Salt Lake smelters, which netted over $2500. They have opened a vein of galena, and as their lease expires in November, the ore is being extracted with all haste. The property is seven miles from Jean, on the San Pedro railroad.

### Nye County

Shipments in tons from Tonopah mines to date and for the week ended July 25, are as follows:

| Mines | Week | Year to Date |
|---|---|---|
| Tonopah Mining | 3,400 | 99,769 |
| Tonopah Belmont | 2,450 | 61,476 |
| Montana-Tonopah | 1,053 | 30,585 |
| Tonopah Extension | 1,065 | 29,348 |
| West End | 800 | 21,349 |
| Midway | ..... | 300 |
| MacNamara | ..... | 10,935 |
| North Star | ..... | 80 |
| Totals | 8,768 | 253,842 |
| Estimated value | $219,200 | ..... |

*Tonopah Mining Co.*—The report for the quarter ending May 31 shows that during that period, ore of the gross value of $832,075 was milled and that the net income amounted to $453,796. Dividends to the amount of $400,000 were paid and $15,239 was spent on exploration work. The cash balance and quick assets amount to $1,875,212.

*Tonopah-Belmont*—A test of the first tailings from the new 500-ton mill indicates that 96.66% of the gold and silver were recovered.

*Tonopah Extension*—A new block of good milling ore has been opened on the 500-ft. level, which is believed to be an entirely new vein.

*MacNamara*—Two new shoots of high-grade ore have been opened on the 275- and 300-ft. levels.

### White Pine County

*Copper Mines Co.*—This company recently shipped about 300 tons of high-grade copper ore to the Steptoe smeltery. The shipment came from the Minnesota claim of the Butcher Boy group.

*Nevada Consolidated*—Five new settling reservoirs have been completed at the Steptoe concentrator, thus enabling a total water saving of 50% to be made. The five reservoirs have a total settling surface of about 90,000 square feet. The water is returned to the mill at the rate of about 5000 gal. per min. The work of building these reservoirs involved the removal of 18,000 cu.yd. of earth. Before the tanks were installed muddy water caused valve trouble and frequent shut downs.

## New Jersey

Diamond drilling of the magnetite orebodies at Ringwood, will soon be started by the Charles Gravey Diamond Drilling Co., of Mineville, N. Y. A magnetometric survey of these deposits was recently completed by S. H. Hamilton.

*United Zinc Co.*—The United Zinc Companies of Maine have brought suit against the former directors and their associates of the United Zinc Companies of New Jersey. The plaintiff is the assignee of the New Jersey company. It charges that the defendant conspired to purchase certain properties and to sell them to the company at exorbitant prices. Damages are placed at $500,000.

## New Mexico

### Grant County

*Doc Walsh*—J. C. McKee, of Hanover, has leased this claim and has drifted into a new shoot of lead-carbonate ore.

*Empire Zinc Co.*—This company, operating in the Hanover district, recently found a rich zinc deposit, and at a place where no surface indications could be seen. This discovery is important, as it seems to confirm the belief that in this district large deposits occur at depth. The work in the past has been largely

near the surface. The shipments are made regularly to Mineral Point, Wis.

*Silver Cell*—The work of developing this mine, near Pinos Altos, recently acquired by G. L. Rule, and associates, of Oklahoma, has been going steadily forward. While retimbering the old shaft, a small shoot was noticed, which was sampled and was found to be rich in silver. A drift was started at once on the shoot which has widened to 17 in. and now shows as a distinct vein.

*Cleveland*—The new mill has been doing satisfactory work. It is expected that the total shipments for the week ended Aug. 1 will be four cars. George Utter, owner.

*Chemung Copper Co.*—Phelps-Dodge & Co. have secured control of this property, in the Burro mountain district. It is reported that about 2,000,000 tons of low-grade ore is blocked out.

*Chino*—The present treatment capacity of the mill is approximately 3000 tons of ore per day in the sections now in operation.

SANTE FÉ COUNTY

*Sunset Mining & Smelting Co.*—The first car of zinc concentrates was recently shipped by this company, of which W. H. Staley is president. Mr. Staley states that there is another car of zinc concentrates and one car of high-grade lead concentrates on the mill floor ready for shipment.

*New State Smelting Co.*—The smeltery on the site of the old stamp mill in the southern part of the city of Socorro has been completed, and now is in blast. W. H. Case, of El Paso, is the promoter of this enterprise.

SOCORRO COUNTY

*Ernestine Mining Co.*—The output for the last ten days of July amounted to 1000 lb. of gold and silver bullion and 5½ tons of concentrates.

## New York

*Hudson Iron Ore Co.*—This company has leased a tract of land adjoining its present workings at Fort Montgomery, on the Hudson River near West Point, and is preparing to sink a new shaft on the property.

## Pennsylvania

*Jones & Laughlin Co.*—During August this company will begin the operation of the first duplex steel process in the Pittsburgh district at its Aliquippa plant. The process is designed to reduce to a minimum the amount of scrap material necessary in making openhearth steel. When this process is started the company will be practically out of the market as a consumer of scrap. The No. 4 stack will be blown in for the first time; then all the 10 stacks of the company will be in operation.

## Oregon

DOUGLAS COUNTY

*Independent*—The Tonopah Mining Co., has taken an option on this copper property near Riddle.

## Utah

JUAB COUNTY

Tintic shipments for the week ended July 26 were 189 cars.

*Yankee*—The development of zinc ore between the 100- and 200-ft. levels continues, and the ore appears to be making in the direction of the May Day, where ore of a similar character is being developed. About six cars of dump ore weekly are being shipped.

*Eagle & Blue Bell*—The third car of ore from the new find on the 700 level has been shipped. For every car mined on the 1300 level three cars are being developed, and more ore is being opened on the 1200. It is thought that the ore opened on each of these levels will be found to belong to the same orebody.

*May Day*—The new electric hoist will soon be in running order, and shipments of zinc ore will begin as soon as freight rates have been adjusted.

*Richmond-Anaconda*—A notice has been sent to stockholders of a meeting to be held Aug. 6, for the purpose of voting on the proposition of bringing the affairs of the company to an end and transferring its property to the Uncle Sam company for the 250,000 shares to be provided by the increase in the capitalization of the latter company from 500,000 to 750,000 shares. The Uncle Sam owns 400,000 of the 500,000 shares, at which the Richmond-Anaconda is capitalized.

*Iron Blossom*—This company shipped 36 cars during the week ended July 26, the output coming about equally from the No. 1 and No. 3 workings.

SALT LAKE COUNTY

Work is being done at the Brandborg Contention, Reed's Peak, and Tar Baby, in Big Cottonwood Cañon.

*Bingham-New Haven*—This company has entered into an agreement with the Utah Consolidated, according to which its ores and concentrates are to be shipped to the International smeltery, at Tooele, by way of the Utah Consolidated tramline. New bins are being built at the Utah Consolidated mill station to accommodate this ore. The Bingham-New Haven adjoins the Utah Consolidated on the south.

*Alta Consolidated*—Five cars of rich ore are on the way to the market.

*Cardiff*—The south drift from the upper-tunnel level is producing 40 to 45 tons of rich ore weekly, and the north drift is being driven through mineralized quartz. The winze, which is being sunk from the upper tunnel, is down 85 ft., with 150 ft. more to go to reach the lower tunnel level. The lower tunnel is in about 530 ft., and the contact is looked for at any time.

*Utah Copper Co.*—All the units of the Magna plant are in operation, as are also 11 of the 13 units of the Arthur mill.

SUMMIT COUNTY

*Thompson-Quincy*—The quartzite-limestone contact has been reached, and ore has been opened. The ore contains silver, some lead, copper and zinc, and a trace of gold. There are rich streaks in the vein.

TOOELE COUNTY

*International*—E. P. Mathewson has asked for an appropriation for two more lead furnaces, making six in all. Material for four furnaces has been ordered and with these completed the plant will have capacity only for ores now being received. Contracts signed and negotiations under way for lead ore will require two more furnaces.

UTAH COUNTY

Ore is being hauled from the Yankee, and the Dutchman is preparing the second shipment of the season, at these American Fork mines.

*Eva*—About 300 tons monthly of rich ore is being shipped. A gasoline hoist and aërial tramway recently installed will make an increase in the output possible.

*Miller Mill*—A car of ore was shipped recently from this American Fork mine, and conditions are promising.

*Pacific*—A car of ore from this American Fork mine has been shipped. Several men are working and another car will soon be ready for shipment.

## Washington

*A.A. 1*—At this mine on Snake River a rich strike at the 600-ft. level has been reported.

## Canada

ALBERTA

Oil has been discovered near Okotokox, about 30 miles southwest of Calgary.

NOVA SCOTIA

*Cape Breton Coal, Iron and R.R. Co.*—The company recently floated a first mortgage bond issue of £300,000, and will reopen the colliery.

ONTARIO

An engineer has been investigating the Sudbury district for the American Smelting & Refining Co., and has under option, a number of nickel properties upon which development work will soon be started. It is the first time that this company

has made any real effort to enter the district, but it has resulted already in a marked move on the part of the other companies to secure more nickel mines.

*Dominion Nickel Copper Co.*—This company has two drills at work on the Murry mine, and the same number will soon be at work on the Cochrane and McVittie, Blue Lake claims recently secured on a working bond.

*Colonial Nickel Co.*—This subsidiary of the International Nickel Co. has acquired options on the Strathcona, Little Bobs, and other nickel properties in the townships of Levack, Morgan, Bowell, Cascaden and others along the North Range, in the Sudbury district. About 8 or 10 diamond drills will be put in operation on these properties before the end of August.

*Canadian Copper Co.*—This company is to operate two diamond drills on the Tam O'Shanter property on the Algoma Eastern R.R., about half way between Copper Cliff and Creighton. This will be the first real development work to be done on the property.

*Mond Nickel Co.*—The company is pushing work on the Coniston smeltery, and many houses are being built. The Canadian Pacific Ry. has just completed a station for the town.

*American Cyanamid Co.*—This company, of Niagara Falls, has made a contract with a construction company of Boston, Mass., to double its capacity, at a cost of $500,000. The company is operating by the Frank & Caro process (German), which produces a nitrogenous fertilizing material, the nitrogen of which is derived from the atmosphere.

### Ontario—Cobalt

*Right of Way*—This company has dropped its options on the properties it has been working in the Silver Mountain district near Port Arthur.

*La Rose*—The financial statement as of July 1 showed cash in the bank and ore on hand, in transit and at the smelteries, to the value of $1,717,710.

*Nipissing*—The statement of July 1 showed cash in the bank and ore on hand and at the smelteries, to the value of $1,493,283.

*Coniagas*—The old shaft in the northeast corner of the property, in the center of the town of Cobalt, will be re-opened and deepened for an exploration of this portion of the property.

*Dominion Reduction Co.*—This company, which is operating the Nova Scotia mill, has made its first shipment of bullion, consisting of 23,603 oz. fine silver, from Crown Reserve ore.

### Ontario—Gowganda

*South Bay*—This Gowganda company has started work and to date four veins carrying silver have been uncovered.

*Millerette*—Good ore is being taken from the lower levels. The small concentrator is handling 45 tons per day.

*Miller Lake-O'Brien*—The main shaft is down 250 ft., and drifting has been begun. A shot drill has proved the vein to another 100 ft. and the shaft will be sunk to that depth.

*Mann*—This company recently acquired the Boyd-Gordon mine.

*McIntyre*—On information furnished by the inspector of mines, this company was fined $100 for negligence resulting in the death of an electrician.

*Preston-East Dome*—This company has closed its Porcupine property, and still having some money to spend, will try leasing in Cobalt.

*Hollinger*—Trouble is still being experienced with the mill, and the bullion output for the month will probably be low.

### Ontario—Porcupine

*Swastika*—Plans for the mill have been prepared and work started on the foundations. The mill will have a capacity of about 60 tons per day. The amalgamating process will be adopted and should conditions warrant it later, a cyanide plant will be installed.

*Kamascotia Lake*—The Detroit men who have purchased 25 claims in Turnbull and Robb townships, have started work with Thomas Rogers, formerly with the Pearl Lake company, as superintendent in charge. They are making a townsite at Kamascotia Lake, 15 miles northwest of the town of Timmins.

### Quebec

*East Canada Smelting*—The new 19,400-ft. Bleichert tramway was put in operation on July 26, carrying as high as 30 tons per hr. though 20 tons is the rated capacity. The tramway was constructed in record time, which is the more noteworthy when it is considered that for two miles of the distance, piles had to be driven for foundations for the towers in crossing a low swampy stretch of land. About 150 tons of 4½% copper ore are being sent out daily by the tram; shortage of labor has up to the present prevented the shipment of 200 tons per day, as planned. A new Canadian Rand 10x12 hoist has been ordered. In cutting No. 4 station, the best grade of ore yet disclosed in the mine was recently encountered.

## Mexico

### Jalisco

*Mezquital Del Oro*—This gold mine north of Guadalajara is under option to an American syndicate. It was extensively developed and operated by an English company, but has been idle except at intervals, for several years.

## Africa

### Rhodesia

Gold production for the month of June was 53,875 oz., or 1789 oz. less than in May. For the half-year ended June 30 the total was 306,269 oz. in 1911, and 314,037 oz.—or $6,491,145—in 1912; an increase of 7768 oz. this year. Other mineral production for the half-year was 86,461 oz. silver, 298 tons lead, 28,935 tons chrome ore and 1.35 tons tungsten ore. The coal mined was 99,482 tons, all from the Wankie colliery.

### Transvaal

Owing to recent attention having been drawn to the accident rate. the government is appointing four additional mine inspectors for the Rand. Now that so many mines are sufficiently developed to enable the breaking of ore to be confined to the day shift only, it is probable that an effort will be made to introduce the blasting gang which will load and fire all holes when the mine is deserted, thus it is hoped to develop better efficiency in the use of explosives and avoiding accidents. There are, however, many objections to this scheme owing to local conditions.

*Victoria Falls Power Co.*—The issue of £1,000,000 debentures was not a success, as the guarantors had themselves to take up the bulk of the issue. This money is to complete the supply stations in the neighborhood of Johannesburg, and there is no intention of reverting to the original scheme for obtaining power from the Victoria Falls.

*State Mines*—The vein intersected by the shaft proved 31 in. in width, assaying 7.15 dwt. This value is considered quite satisfactory, and gives evidence of the existence of another large mine between the New Modderfontein, Geduld and Brakpan. The reef was also intersected at 1800 ft. in the Rand Klip mine on the east of Modder B; it assayed 2.18 dwt. over 54 in.

*Consolidated Langlaagte*—The new 100-stamp mill is ready to start when electric current is available from the Victoria Falls Power Co's new stations.

## Asia

### Chosen

*Oriental Consolidated Mining Co.*—The clean-up for July was $135,000. At present grinding is being done to finer size than formerly; 90% of the material now passes a 200-mesh screen. The circulation pumps for the Merrill precipitation presses have been speeded up and by the addition of another Pachuca agitator the time of agitation can be increased 20%, thereby increasing the extraction, which even now is high. It is thought that a recovery of 95% of the gold can be effected eventually.

# The Market Report

**Current Prices of the Metals, Minerals, Coal and Mining Stocks**

## Coal Trade Review

*New York, Aug.* 7.—There is practically no change in coal trade conditions in the West. A gradual improvement in general business is going on. Lake trade is better, as coal is moving more freely.

The seaboard bituminous trade shows a little better demand and corresponding firmness in prices. Coastwise trade is improving.

Anthracite trade continues active and the collieries are busy making up the deficit caused by the stoppage of mining in April and May. July and August shipments are expected to be heavy.

*United States Foreign Trade*—Imports of coal and coke into the United States six months ended June 30, long tons:

| | 1911 | 1912 | Changes |
|---|---|---|---|
| Anthracite | ..... | 23 | I. 23 |
| Bituminous | 693,271 | 754,645 | I. 61,374 |
| Coke | 44,945 | 41,127 | D. 3,818 |
| Total | 738,216 | 795,795 | I. 57,579 |

Canada furnished this year 669,697 tons of coal and nearly all the coke; Australia, 76,476 tons of coal.

Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, six months ended June 30, long tons:

| | 1911 | 1912 | Changes |
|---|---|---|---|
| Anthracite | 1,706,134 | 1,131,453 | D. 574,681 |
| Bituminous | 5,577,567 | 6,405,519 | I. 827,952 |
| Coke | 512,271 | 500,048 | D. 12,223 |
| Bunker coal | 3,296,617 | 3,718,480 | I. 421,863 |
| Total | 11,092,589 | 11,755,500 | I. 662,911 |

The bunker or steamship coal is practically all bituminous. Canada took this year 5,098,055 tons of coal; Cuba and the West Indies, 956,111; Mexico, 190,843; Panama, 239,879 tons.

## Iron Trade Review

*New York, Aug.* 7—The position of the iron and steel markets remains much the same. Business is remarkably active for the season and the mills generally are so full that deliveries are getting to be quite an important question. Some of the structural and plate mills, for instance, talk about three or four months on new deliveries. Prices are working up gradually and advances do not seem to check new business.

In the pig-iron market the chief incident has been the placing of some large orders for bessemer pig with merchant furnaces by the Steel Corporation and by some independent concerns. One contract is reported to be for 100,000 tons. Outside of this there have been some large sales of basic pig, and fair orders for foundry iron. Sellers are firmer in their views, especially for deliveries running into the third quarter of the year.

Weather conditions have lately been quite favorable to steel-mill operations, but the labor supply is as poor as ever, and there is universal complaint. At many points the shortage is cutting into production, although probably only by a few per cent. July was relatively a poor month for shipments, as a number of mills were closed for various periods for repairs, and a very hot spell early in the month affected production seriously. It may be estimated that shipments of steel products averaged 15 per cent. less in July than in June, but this is a small decrease compared with what usually occurs in July. A few interests maintained shipments, but some experienced a decrease of fully 20 per cent. August shipments will be larger, and if weather conditions are favorable they will probably equal the rate in June. The realized prices on shipments are gradually increasing, but at rather a slow rate. The mills really have a large tonnage of low-priced business on books, and while they have been making sales right along as prices advanced, the additional tonnages sold are relatively small.

The Stanley Committee, which has been investigating the Steel Corporation, has presented its report—or rather its reports, for there are two minority statements. The majority report recommends legislation to restrain trust operation in various ways; one minority report adopts Judge Gary's views, including some government regulation of prices. It is not likely that Congress will take any action on the reports at this session.

*Alloy Steel Rails*—The quantity of alloy steel rails made in 1911, as reported by the American Iron & Steel Association, was 153,898 tons, of which 115,450 tons were bessemer and 37,540 tons open-hearth titanium steel. The remaining 998 tons were nickel and manganese steel. The total quantity was 103,426 tons less than in 1910. Alloy steel rails were 5.4% of all rails made in 1911. There were 462 tons of rails made from steel refined in the electric furnace.

### Baltimore

*Aug.* 5—Exports for the week included 44,693 lb. lead, 295,540 lb. steel rails and 100,824 lb. angles and bars to Belfast; 788,990 lb. steel billets and 440,310 lb. scrap steel to Glasgow. Imports included 11,650 tons iron ore from Cuba.

### Birmingham

*Aug.* 5—Southern pig-iron sales right now equal about the make if not a little more. Preparations are under way for an increased iron make, one furnace to be blown in during the next two weeks by the Sloss-Sheffield Steel & Iron Co. and another to be ready by the end of the month. The Sloss-Sheffield Co. is pushing the work on a second furnace and will have it ready before long.

Pig iron quotations are around $12 per ton, No. 2 foundry. While the prices for third-quarter delivery are stated at $11.50, there is very little iron selling at that price. Much care is being exercised in the sale of low-grade iron, the furnace companies not caring to stock up too strongly on this kind of business. A few sales in lots of 500 and more tons have been booked recently. Southern cast-iron pipe makers will need considerable iron for the balance of the year. The Central Foundry Co. will have its new pipe foundry at Holt in operation in the next few days while the United States Cast Iron Pipe & Foundry Co. will have its Dimmick plant at North Birmingham in full operation soon also.

There is a steady demand for steel rails, fabricated steel and wire goods. The plants of the Tennessee Co. at Ensley and Bessemer and the plant of the Southern Iron & Steel Co. at Gadsden, are doing well.

### Chicago

*Aug.* 5—Sales of pig iron have been light in the last week, compared with the previous week, but have amounted to a fair tonnage for midsummer. Most of the buying has been in small lots—of less than 1000 tons each—though inquiries continue concerning some larger amounts. Prices held firm, Northern No. 2 selling at $15.50 furnace, which means about $15.90 delivered, and Southern at $12 Birmingham, or $16.35 Chicago.

Most of the users of large amounts of pig iron seem now to be well supplied for the last half and they are looking more anxiously than the furnace agents to first-quarter requirements. At current prices much tonnage for the first quarter no doubt could be placed, but the sellers demand a premium and the melters are unwilling to pay it. Hence there seems

likely to be a pause in buying until contracting generally for 1913 needs begins. The local furnaces are well sold up for this year's output and are not seeking much new business at current prices.

The market for iron and steel products continues active, despite further advances in prices. Some 28,000 tons of standard rails have been bought by railroads within the week and the demand for track fastenings is heavy. Building material continues in large demand over a wide territory and bars, plates and sheets sell heavily without effort of the producers. It is a strong market all around and one that seems destined to continue strong.

## Cleveland

*Aug.* 5—A few small sales of ore are reported, but no large business is expected now.

*Pig Iron*—Business is active and the market is stronger. For the moment there is an unusually wide range on prices, but the tendency is towards the higher limit. Quotations, Cleveland delivery, are $15.15@15.50 for bessemer, $13.75@14 for basic, $13.75@14.25 for No. 2 foundry, and $16.25@16.50 for Lake Superior charcoal.

*Finished Material*—Specifications are heavy and the question of deliveries is coming up with many mills. There is no hunting for orders. The recent advances in price are generally well maintained.

## Philadelphia

*Aug.* 7—The exceptionally strong position of the pig-iron market continues, notwithstanding demand has subsided somewhat. Some business would be done were furnace interests disposed to accept contracts for 1913 delivery. Makers are satisfied with the condition of their order books and see no occasion to sacrifice chances for higher prices later on by loading up at present figures. The larger consumers throughout the territory buying from eastern Pennsylvania are too well supplied for most of this year to bother over what course the market may take. Consumption requirements are increasing steadily. In low-grade irons for pipe-making purposes, several round lots were purchased for forward delivery as a protection against an impending advance. Southern furnace interests are in no position to make any trouble at present. Basic pig is nominally higher than a week ago and is hard to order. No. 2 X foundry is also quoted higher in response to a few large consumers, who are only sounding the market. The sentiment in crude-iron circles here is to let things drift, and to stand by outside quotations. No. 2 X foundry is $15.75@16.25; forge, $15.25; basic, $16; phosphorus, $20 per ton.

*Steel Billets*—Openhearth is quoted at $25.40, forging, $29.40, with probability of an advance.

*Bars*—All reporting mills are booking business faster than deliveries are made. The advance rather stimulates than retards business.

*Sheets*—An advance on loose-rolled sheets has been made and the volume of business is increasing.

*Pipes and Tubes*—The advance has served to quicken the activities of several consumers, who have been buying in a hand-to-mouth way.

*Plates*—The rush of enterprise in all lines of work calling for plates is overtaxing mill capacity. Some more orders for Western delivery have come to Eastern mills. In increasing instances premiums are offered.

*Structural Material*—It seems to be the rule rather than the exception to offer premiums, especially on the general run of orders floating in and calling for delivery this fall. Unlooked-for business is springing up.

*Scrap*—There is a decided scarcity of scrap for steel mills and orders are now in hand to be filled as soon as the stuff can be gathered together.

## Pittsburgh

*Aug.* 6—The market on bars, plates and shapes is quotable at the $1 a ton advance stated as being in progress at the date of last report. Bars are now 1.30c. and plates and shapes 1.35c., Pittsburgh. While the steel mills do not admit that there is anything but an open market in steel products, the circumstantial evidence is that there is knowledge in certain quarters of these advances before they occur, and that when one interest makes an advance in its own prices, all others follow the advance within 48 hours.

Under date of Aug. 1 two of the principal producers of wrought-iron pipe in this district advanced their prices one point, and as another producer had already made an advance this may be considered general, although a large eastern Pennsylvania producer did not advance with the central western interests. The card discount on wrought-iron pipe, ¾ to 1½-in., inclusive, is now 73% off on black and 62% off on galvanied, advances in iron pipe corresponding to the two successive advances in steel pipe, July 24 being the date of the second advance.

*Pig Iron*—The Youngstown Sheet & Tube Co. has bought a large tonnage of bessemer pig iron, reported in some quarters as 50,000 tons and in others as 100,000 tons, details being carefully withheld. The purchases have served to stiffen the market, but prices were arranged before the advance from $14.25 to $14.50, Valley, reported last week. In addition, the company bought 20,000 tons of gray forge. The purchases of the Westinghouse Air Brake Co., referred to in last report, are now stated to have totaled 22,000 tons, of No. 2 foundry, forge and malleable. The Standard Sanitary Manufacturing Co. has since purchased 13,000 tons, for fourth quarter, 9000 tons of No. 2 foundry at $13.50, 1000 tons of the same at $13.25, 1500 tons of No. 3 at $13.25 and 1500 tons of forge at $13, prices named being f.o.b. furnace, one in the Valleys and one outside. It is doubtful whether much more foundry or forge iron can be secured at these figures. Sales of basic are reported, in some cases at higher than $13.50, Valley, but the sales are not fully identified and it is a question whether the market is yet quotable above this figure, although indications are that it shortly will be. The pig-iron averages, compiled by a trade interest from actual transactions, are given out for July as $14.25 on bessemer and $13.48 on openhearth, at Valley furnaces. We quote: Bessemer, $14.50; basic, $13.50@13.75; No. 2 foundry and malleable, $13.50; forge, $13@13.25, all at Valley furnaces, 90c. higher delivered Pittsburgh.

*Ferromanganese*—The ferromanganese market has been relatively quiet since the $2.50 advance, and we quote prompt and forward at $51, Baltimore.

*Steel*—Transactions have been light and prices are not closely quotable because producers are so well sold up for the current quarter. For fourth quarter a few sales appear to have been made, at advances over third-quarter figures. We quote as follows for prompt and third quarter, with the observation that it might be difficult to secure any delivery desired: Bessemer billets, $21.50@22; bessemer sheet bars, $21.75@22; openhearth billets, $22@22.50; openhearth sheet bars, $22.50@23, all f.o.b. maker's mill, Pittsburgh or Valley.

*Sheets*—Specifications are coming in at a heavy rate, fully as well as in June, and prices are stiffening. Mills are running better than early in July, repairs having been pretty well completed. We quote: Black sheets, 28-gage, 2@2.05c.; galvanized, 28-gage, 3.05@3.15c.; blue annealed, 10-gage, 1.45@1.50c.; painted corrugated, 28-gage, 2.20@2.25c.; galvanized, 3.10@3.20c. per lb., Pittsburgh.

*Connellsville Coke*—The tone of the market has improved. There have been sales of prompt at $2.25, and one sale of 15,000 tons for August and September shipment at $2.30, while there is fairly large inquiry this week, much larger than in immediately preceding weeks. While certain of the operators still have an arrangement which has the appearance of artificial control, the market is really an open one, there being several other sellers, who are holding prices more firmly

than formerly and expect the market to move upward as sales are made. We quote prompt furnace at $2.25@2.30; contract furnace at $2.30@2.35; prompt foundry at $2.40@2.50; contract foundry at $2.40@2.75, all at ovens.

### St. Louis

*Aug.* 5—Business in pig iron is quite active, with a number of sales and more inquiries. Southern No. 2 foundry is quoted $11.50@12, Birmingham—$15.25@15.75, St. Louis—the tendency being to the higher figure. Northern No. 2 foundry is quoted $15.75, St. Louis. Sales of finished products are good.

Coke is firm, good foundry bringing $5.65 per ton, St. Louis.

### Iron Ore Trade

Exports and imports of iron and manganese ores in the United States, six months ended June 30, long tons:

| | 1911 | 1912 | Changes |
|---|---|---|---|
| Iron ore, imp. | 801,868 | 994,476 | I. 192,608 |
| Iron ore, exp. | 232,004 | 294,604 | I. 62,600 |
| Manganese, imp. | 84,325 | 104,432 | I. 20,107 |

Iron-ore imports this year included 59,341 tons from Spain, 50,140 from Newfoundland, 200,606 from Sweden and 661,390 tons from Cuba.

## Foreign Iron Trade

*Chinese Iron and Steel*—The Han-yeh-ping Iron & Coal Co. reports for 1911 a production of 93,327 tons of pig iron. Sales in China were 9824 tons. Shipments abroad were to Saigon, 40; Australia, 5765; United States, 4465; Japan, 58,535 tons. Production of steel bars were 1250 tons and of rails, 24,216 tons, all sold in China.

### United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for six months ended June 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

| | 1911 | 1912 | Changes |
|---|---|---|---|
| Exports | $124,733,874 | $143,364,185 | I. $18,630,311 |
| Imports | 15,928,432 | 13,475,783 | D. 2,442,649 |
| Excess, exp. | $108,805,442 | $129,888,402 | I. $16,187,662 |

Increase in exports, 14.9%; decrease in imports, 15.3%. The leading articles of iron and steel were, in long tons:

| | Exports 1911 | Exports 1912 | Imports 1911 | Imports 1912 |
|---|---|---|---|---|
| Pig iron | 77,129 | 131,649 | 88,988 | 55,918 |
| Scrap | 45,518 | 55,280 | 11,656 | 8,120 |
| Billets, blooms, etc. | 135,941 | 135,955 | 18,944 | 9,279 |
| Bars | 73,146 | 93,476 | 19,546 | 10,880 |
| Rails | 218,880 | 225,563 | ..... | 1,056 |
| Sheets and plates | 165,217 | 260,366 | 1,242 | 1,330 |
| Structural steel | 104,378 | 132,478 | ..... | 920 |
| Wire-rods | 8,489 | 32,788 | 8,817 | 7,262 |
| Wire | 107,269 | 114,423 | ..... | ..... |
| Nails and spikes | 36,450 | 50,503 | ..... | ..... |
| Tinplates | 24,579 | 45,776 | 12,069 | 1,002 |
| Pipe and fittings | 86,128 | 121,249 | ..... | ..... |

Imports of wire are not reported in quantities; values were $420,970 in 1911 and $420,714 in 1912. Exports of mining machinery in 1912 were valued at $3,343,963, a decrease of $192,769 from last year.

# Metal Markets

*New York, Aug.* 7—The metal markets show only moderate activity, but there have been some fluctuations in prices. Lead is lower.

### Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

| Metal | Exports | Imports | Excess |
|---|---|---|---|
| Gold | | | |
| June 1912 | $ 7,149,035 | $ 5,611,057 | Exp. $1,537,978 |
| " 1911 | 3,074,755 | 4,767,714 | Imp. 1,692,959 |
| Year 1912 | 33,374,836 | 25,264,342 | Exp. 8,110,494 |
| " 1911 | 13,251,562 | 33,773,026 | Imp. 20,521,464 |
| Silver | | | |
| June 1912 | 5,045,944 | 4,879,485 | Exp. 166,459 |
| " 1911 | 5,777,703 | 3,506,446 | Exp. 2,271,257 |
| Year 1912 | 33,668,972 | 25,264,249 | Exp. 8,404,723 |
| " 1911 | 34,443,203 | 21,960,601 | Exp. 12,482,602 |

Exports from the port of New York, week ended Aug. 3: Gold, $686; silver, $1,294,299, chiefly to London. Imports: Gold, $79,434; silver, $144,825, from Mexico, Central and South America.

*Gold*—The price of gold on the open market in London remained at the bank level, 77s. 6d. per oz. for bars and 76s. 4d. per oz. for American coin. There was no special demand.

*Iridium*—The price for pure metal is a little higher at $63.50 per oz., New York.

*Platinum*—The market remains rather quiet, but there is no change. Dealers still ask $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

*Silver*—The silver market during the past week has been exceedingly quiet, the prices fluctuating between 27 11/16 and 27 9/16d. in London. Moonsoon reports from India continue favorable and the market closes steady with higher tendency.

SILVER AND STERLING EXCHANGE

| Aug. | 1 | 2 | 3 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| New York | 59⅞ | 60 | 59⅞ | 59⅞ | 60 | 60⅛ |
| London | 27 5/16 | 27 5/16 | 27 5/16 | .... | 27⅛ | 27 11/16 |
| Sterling Ex. | 4.8715 | 4.8710 | 4.8685 | 4.8700 | 4.8705 | 4.8710 |

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver. 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to July 25, as reported by Messrs. Pixley & Abell:

| | 1911 | 1912 | Changes |
|---|---|---|---|
| India | £4,895,300 | £4,068,200 | D. £ 827,100 |
| China | 890,400 | 933,500 | I. 43,100 |
| Total | £5,785,700 | £5,001,700 | D. £ 784,000 |

### Copper, Tin, Lead and Zinc

*Copper*—During the last week the market has been extraordinarily dull. European consumers seem to be feeding on the stocks accumulated over there and consequently refraining from buying in this market, especially inasmuch as they are supplied on favorable terms by interests holding copper who desire to realize. American consumers seem to be well provided for the time being and buy sporadically only. The largest agencies are standing pat for their price of 17¾c., delivered, usual terms, and claim to have made some sales thereat, but such take place manifestly under special conditions, copper being offered liberally at 17⅝c. by other agencies, some of whom report transactions at that price and others reporting failure to draw orders. Lake copper has sold at 17½@17⅝c., cash, New York, in lots of fair size. At the close Lake copper is quoted 17½@17¾c., electrolytic in cakes, wirebars or ingots, 17.45@17.50c. Casting copper is quoted nominally at 17¼@17⅜c., as an average for the week.

The London market for standard has fluctuated within narrow limits, and as a whole transactions were not large and there was no decided trend to the mar-

NEW YORK

| Aug. | Copper: Lake, Cts. per lb. | Copper: Electrolytic, Cts. per lb. | Tin: Cts. per lb. | Lead: New York, Cts. per lb. | Lead: St. Louis, Cts. per lb. | Zinc: New York, Cts. per lb. | Zinc: St. Louis, Cts. per lb. |
|---|---|---|---|---|---|---|---|
| 1 | 17½ @17¾ | 17.45 @17.50 | 45 | 4.70 | 4.52½ @4.55 | 7.00 @7.10 | 6.85 @6.95 |
| 2 | 17¾ @17¾ | 17.45 @17.50 | 44⅝ | 4.67½ @4.70 | 4.52½ @4.55 | 7.00 @7.10 | 6.85 @6.95 |
| 3 | 17½ @17¾ | 17.45 @17.50 | 44⅝ | 4.67½ @4.70 | 4.52½ @4.55 | 7.00 @7.10 | 6.85 @6.95 |
| 5 | 17¾ @17¾ | 17.45 @17.50 | 44⅝ | 4.50 | 4.35 @4.37½ | 6.90 @7.00 | 6.75 @6.85 |
| 6 | 17½ @17¾ | 17.45 @17.50 | 45¼ | 4.50 | 4.35 @4.37½ | 6.90 @7.00 | 6.75 @6.85 |
| 7 | 17½ @17¾ | 17.45 @17.50 | 45⅛ | 4.50 | 4.35 @4.37½ | 6.90 @7.00 | 6.75 @6.85 |

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

| Aug. | Copper: Spot | Copper: 3 Mos | Copper: Best Sel'td | Tin: Spot | Tin: 3 Mos | Lead, Spanish | Zinc, Ordinaries |
|---|---|---|---|---|---|---|---|
| 1 | 77⅞ | 78¼ | 83 | 204 | 201¾ | 18½ | 26¼ |
| 2 | 78¾ | 78½ | 83 | 202¼ | 199¾ | 19 | 26¼ |
| 3 | .... | .... | .... | ..... | ..... | .... | .... |
| 5 | .... | .... | .... | ..... | ..... | .... | .... |
| 6 | 78¾ | 78¾ | 83¼ | 204½ | 202¼ | 19¼ | 26¼ |
| 7 | 78 | 78⅛ | 83¼ | 204 | 201¾ | 19⅜ | 26¼ |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

ket. On Aug. 1, spot closed at £77 17s. 6d. and three months at £78 2s. 6d.; on Aug. 2, it was 10s. higher. There was no exchange on Aug. 5, and on Aug. 6 the market was a trifle better at £78 10s. for spot and £78 15s. for three months. On Aug. 7 the bears were again in evidence, and the market closes lower at £78 for spot and £78 2s. 6d. for three months.

Copper sheets are 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Visible stocks of copper in Europe on July 31 are reported as follows: Great Britain, 28,620; France, 7480; Rotterdam, 750; Hamburg, 4830; afloat from Chile, 2900; afloat from Australia, 6000; total, 50,580 long tons, or 113,299,200 lb.; an increase of 1490 tons over the July 15 report.

*Tin*—The market has been without special feature. After the Banka sale, the London market declined, and as the London exchange was closed from Friday afternoon until Tuesday, on account of the bank holiday, business here was practically at a standstill during that time. The market was weak on Aug. 1 and 2, but when on Aug. 3 London opened higher, our market followed suit, and closes at about 45⅛c. for this month's delivery.

On Aug. 1, the London market closed at £204 for spot and £201 15s. for three months, declined the next day to £202 5s. for spot and £199 15s. for three months. On Aug. 6 it advanced over £2 spot closing at £204 10s. and three months at £202 5s., closing on Aug. 7 at £204 spot and £201 2s. 6d. for three months.

*Lead*—On Monday, Aug. 5, the American Smelting & Refining Co. reduced its price ¼c., to 4.50c., and at this level there has been a better demand. At the close, St. Louis is quoted 4.35@4.37½c., and New York 4.50 cents.

The London market is firm. The scarcity of prompt material continues, and good Spanish lead has advanced to £19 7s. 6d. for prompt delivery. English lead is held at £19 10s. It is also noteworthy that there is a good demand for lead at the present level for forward delivery. The market closes at £19 17s. 6d. for Spanish lead, with English 2s. 6d. higher.

*Spelter*—The market has been quiet and somewhat easier. Some of the smelters have been desirous of marketing, having accumulated near-by spelter and have pressed this for sale. There has also been a disposition to take orders for the fourth quarter of the year. Prices are slightly lower, and at the close St. Louis is quoted 6.75@6.85c.; New York 6.90@7 cents.

The London market is firm, good ordinaries being quoted £26 5s. and specials £27 per ton.

Base price of zinc sheets is $8.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼@7⅜c. per lb. in carload lots, New York.

## Other Metals

*Aluminum*—The market has been a little more active, with fair sales. Prices are firmer at 24¼@24½c. per lb. for No. 1 ingots, New York.

*Antimony*—Business continues active and prices are firm. Cookson's is held at 8.60c. per lb. for spot and early deliveries and 8.50c. for September and forward. Hallett's and U. S. are 8c. for spot, while 7.50@7.75c. per lb. is asked for Hungarian, Chinese and other outside brands. All prices are ex-dock, New York.

*Quicksilver*—Business is fair and prices here are unchanged. New York quotations are $42.50 per flask of 75 lb., with 60@62c. per lb. asked for retail lots. San Francisco, $42 for domestic orders and $39.50 for export. The London price has been reduced 5s. and is now £8 5s. per flask, with the same price named from second hands.

## Imports and Exports of Metals

Exports and imports of metals in the United States, six months ended June 30, are reported as follows, in the measures usual in the trade:

| Metals | Exports | Imports | Excess |
|---|---|---|---|
| Copper, long tons | 171,312 | 93,044 | Exp. 78,268 |
| Copper, 1911.... | 170,541 | 77,855 | Exp. 92,686 |
| Tin, long tons.... | 332 | 26,075 | Imp. 25,743 |
| Tin, 1911..... | 763 | 20,687 | Imp. 19,924 |
| Lead, short tons. | 37,574 | 48,802 | Exp. 11,228 |
| Lead, 1911..... | 57,332 | 46,169 | Imp. 11,163 |
| Zinc, short tons.. | 5,367 | 3,078 | Exp. 2,289 |
| Zinc, 1911..... | 3,238 | 1,166 | Exp. 2,072 |
| Nickel, lb..... | 12,618,669 | 15,735,845 | Imp. 3,117,176 |
| Nickel, 1911.... | 11,156,865 | 14,379,710 | Imp. 3,222,845 |
| Antimony, lb..... | 51,132 | 8,207,650 | Imp. 8,156,518 |
| Antimony, 1911. | 150,704 | 5,246,330 | Imp. 5,095,626 |
| Platinum, oz..... | ..... | 49,431 | Imp. 49,431 |
| Platinum, 1911. | 47 | 53,400 | Imp. 53,353 |
| Aluminum, lb.... | 9,656 | 10,660,688 | Imp. 10,651,032 |
| Aluminum, 1911 | ..... | ..... | ..... |
| Ores, etc. | | | |
| Zinc in ore, lb... | 13,344,407 | 14,283,936 | Imp. 939,529 |
| In ore 1911.... | 12,300,655 | 16,369,122 | Imp. 4,068,467 |
| Zinc oxide, lb. .. | 18,153,842 | ..... | Exp. 18,153,842 |
| Zinc oxide, '11.. | 17,797,759 | ..... | Exp. 17,797,759 |
| Zinc dross, lb.... | 384,695 | ..... | Exp. 384,695 |
| Zinc dross, '11.. | 4,991,630 | ..... | Exp. 4,991,630 |
| Chrome ore, l.t.. | ..... | 31,566 | Imp. 31,566 |
| Chrome ore, '11 | 5 | 22,868 | Imp. 22,863 |

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 25,829 tons; exported, 12,240. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include reexports of foreign materials.

## Zinc and Lead Ore Markets

*Platteville, Wis., Aug. 3*—The base price paid this week for 60% zinc ore was $60. The base price paid for lead was $58@59 per ton.

SHIPMENTS, WEEK ENDED AUG. 3

| Camps | Zinc ore, lb. | Lead ore, lb. | Sulphur ore, lb. |
|---|---|---|---|
| Shullsburg..... | 890,000 | ..... | ..... |
| Mineral Point..... | 774,180 | ..... | ..... |
| Galena ..... | 551,000 | ..... | ..... |
| Platteville ..... | 486,000 | ..... | 294,700 |
| Hazel Green..... | 440,000 | ..... | ..... |
| Benton..... | 378,500 | ..... | 758,200 |
| Cuba City..... | 252,320 | ..... | 231,600 |
| Harker..... | 171,870 | ..... | ..... |
| Highland..... | 113,600 | ..... | ..... |
| Linden ..... | 63,910 | ..... | 60,000 |
| Total..... | 4,121,380 | ..... | 1,344,500 |
| Year to date..... | 121,777,980 | 5,181,290 | 19,178,370 |

Shipped during week to separating plants, 2,415,880 lb. zinc ore.

*Joplin, Mo., Aug. 3*—The high price of zinc sulphide ore this week is $65.50, the base per ton of 60% zinc was $58@62.50. Zinc silicate sold for $32@34 per ton of 40% zinc. The average price all grades was $57.68. The high price of lead ore was $62 and the average price, all grades, was $59.80 per ton.

The zinc market took a slump this week and the high base went down to $62.50 and had it not been for the heavy buying of one company it would probably not have been that high. The demand eased up on the part of two of the other companies that have been buying heavily the past few weeks and by Thursday it was seen that the prices were

SHIPMENTS, WEEK ENDED AUG. 3

| | Blende | Calamine | Lead Ore | Value |
|---|---|---|---|---|
| Webb City-Carterville | 4,234,770 | ..... | 966,800 | $156,047 |
| Joplin..... | 2,599,850 | ..... | 255,130 | 85,521 |
| Galena..... | 688,510 | ..... | 156,830 | 24,964 |
| Alba-Neck.... | 777,760 | ..... | 13,440 | 24,124 |
| Duenweg..... | 740,280 | ..... | 24,460 | 22,941 |
| Miami..... | 420,480 | ..... | 131,220 | 14,868 |
| Oronogo..... | 539,090 | ..... | ..... | 13,809 |
| Granby ..... | 322,600 | 324,580 | 7,060 | 12,970 |
| Cave Springs. | 113,960 | ..... | 317,540 | 12,830 |
| Carl Junction | 318,340 | ..... | ..... | 9,710 |
| Spurgeon .... | 152,600 | 193,310 | 31,480 | 8,623 |
| Wentworth... | 218,730 | ..... | ..... | 6,342 |
| Lawton..... | 189,400 | ..... | ..... | 5,492 |
| Carthage..... | 143,000 | ..... | ..... | 4,147 |
| Springfield.... | 88,000 | ..... | ..... | 2,550 |
| Sarcoxie..... | 62,320 | ..... | ..... | 1,806 |
| Totals..... | 11,609,690 | 517,890 | 1,903,960 | $406,744 |
| 31 weeks... | 316,344,230 | 19,066,010 | 54,143,340 | $9,953,132 |

Blende val., the week, $341,914; 31 weeks, $8,168,215
Calamine, the week, 7,886; 31 weeks, 285,732
Lead value, the week, 56,944; 31 weeks, 1,499,185

MONTHLY AVERAGE PRICES

| Month | Zinc Ore: Base Price | | Zinc Ore: All Ores | | Lead Ore: All Ores | |
|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 |
| January..... | $41.85 | $44.90 | $40.55 | $43.54 | $55.68 | $58.92 |
| February.... | 40.21 | 45.75 | 39.16 | 43.31 | 54.46 | 52.39 |
| March..... | 39.85 | 51.56 | 38.45 | 49.25 | 54.57 | 54.64 |
| April..... | 38.88 | 52.00 | 37.47 | 50.36 | 56.37 | 54.18 |
| May..... | 38.25 | 55.30 | 36.79 | 53.27 | 55.21 | 52.45 |
| June..... | 40.50 | 55.88 | 38.18 | 54.38 | 56.49 | 55.01 |
| July..... | 40.75 | 58.85 | 38.36 | 56.59 | 58.81 | 58.83 |
| August..... | 42.50 | ..... | 41.28 | ..... | 60.74 | ..... |
| September.. | 42.63 | ..... | 41.29 | ..... | 59.33 | ..... |
| October..... | 42.38 | ..... | 40.89 | ..... | 54.72 | ..... |
| November... | 45.40 | ..... | 43.25 | ..... | 57.19 | ..... |
| December... | 44.13 | ..... | 40.76 | ..... | 62.03 | ..... |
| Year..... | $41.45 | ..... | $39.90 | ..... | $56.76 | ..... |

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

going to be lower. Mine operators are having considerable trouble by strikes for higher wages, but the strikes are of short duration as the demands of the strikers are met on account of the high price of ore.

## Chemicals

*New York, Aug. 7*—The general market is quiet, with only a midsummer business forward.

*Arsenic*—Material for early delivery is still scarce and prices are irregular. Spot is quoted at $4.50@5 per 100 lb. Futures are $3.75@4.25, with little doing.

*Nitrate of Soda*—Spot price is unchanged at 2.45c. per lb. Futures are higher at 2.47½c. for September, 2.50c. for October-December, and 2.52½c. for January positions.

CURRENT WHOLESALE PRICES

| | |
|---|---|
| Ammonium sulphate . . . . . cwt. | 3.25@3.28 |
| Arsenic, white . . . . . lb. | 0.03¾@0.05 |
| Barytes, ground . . . . . sh. ton | 12.50@14.00 |
| " floated . . . . . sh. ton | 16.00@17.00 |
| Calcium acetate, gray . . . . . cwt. | 2.50@2.55 |
| carbide, tons lot f.o.b. Niagara Falls. . . .sh. ton | 70.00 |
| Carbons, good drill quality . . . . carat | 85.00 |
| Cement, Port., Am. . . . . 400-lb. bbl. | 1.33 |
| Chrome brick, f.o.b., Pittsburg. . .M. | 175.00 |
| ore, 50%, ex-ship, N. Y., lg. ton | 14.00@16.00 |
| Copperas, bulk. . . . . cwt. | 0.55 |
| bbl. . . . . cwt. | 0.65@0.85 |
| Copper sulphate. . . . . cwt. | 5.50@5.75 |
| Fluorspar, lump, f.o.b. Pittsburg ton | 8.00@9.00 |
| Magnesite, crude, 95%. . . . lg. ton | 9.00@11.00 |
| calcined, powdered. . . . . | 30.00@35.00 |
| brick, dom., f.o.b. Pittsburg. . . . . M. | 160@180 |
| Paints, litharge, Am. powd. . . . . lb. | 0.07@0.07½ |
| red lead, American. . . . . lb. | 0.07@0.07½ |
| white lead, Am., dry. . . . . lb. | 0.05½@0.06¼ |
| zinc white, Am., dry. . . . . lb. | 0.05½@0.06¼ |
| Phosphates, acid: | |
| *Fla., hard rock 77%. . . . . | 5.75@6.25 |
| land pebble 68%. . . . . | 3.70@3.80 |
| †Tenn., 78@80%. . . . . | 5.00@5.50 |
| 75%. . . . . | 4.75@5.00 |
| 68@72%. . . . . | 4.25@4.50 |
| †So. Car. land rock 60%. . . . . | 3.50@3.75 |
| Potassium cyanide, 98@99%. . . . lb. | 0.19 |
| Pyrite: | |
| Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit. . . . . | 0.12@0.12½ |
| Domestic, non-arsenical, fines, per unit, f.o.b. mines. . . . . | 0.11½@0.12 |
| Imported, non-arsenical, furnace size, ex-ship, per unit. . . . . | 0.13½ |
| Imported, arsenical, furnace size, size, ex-ship, per unit. . . . . | 0.12½@0.13 |
| Imported, fines, arsenical, ex-ship. | 0.11@0.12 |
| Imported, fines non-arsenical, ex-ship, per unit. . . . . | 0.12½ |

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

| | |
|---|---|
| Sodium cyanide, 120 to 130% KCN (per 100%). . . . . lb. | 0.18 |
| nitrate 95% spot. . . . . cwt. | 2.45 |
| 95% future. . . . cwt. | 2.47½@2.52½ |
| Sulphur, Louisiana prime, N. Y, lg. ton | 22.00@22.50 |
| roll. . . . . cwt. | 1.85@2.15 |
| flour. . . . . cwt. | 2.00@2.40 |
| flowers, sublimed. . . . . cwt. | 2.20@2.60 |
| pow. com., bags. . . . . cwt. | 1.50 |
| Sicilian, crude brimstone lg. ton | 22.50 |
| Zinc chloride, granular. . . . . lb. | 0.04½@0.04½ |

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. †On vessel Ashley River, S.C.

Note—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in their selling output on private contract.

## Petroleum

Exports of mineral oils from the United States in June were 147,859,275 gal. For the six months ended June 30 the total exports were 826,578,486 gal. in 1911, and 842,083,490 gal. in 1912; an increase of 15,505,004 gal., or 1.9%, this year.

## Mining Stocks

*New York, Aug. 7*—On Aug. 1 the Exchange was fairly active, with a general upward movement in prices. The Curb was active, but rather irregular. El Paso Consolidated and Stewart Mining advanced, but Tonopah Merger and West End Extension declined. Copper shares were dull and generally off a fraction.

Aug. 2 saw a few reactions but general firmness on the Exchange. The Curb was again rather irregular, the copper stocks showing most activity. Standard Oil, old stock, changed hands at $1040 per share.

Aug. 3, business on the Exchange was broader and more active, with moderate advances. The Curb trading was rather limited by the short day. Coppers were firm, business in other mining stocks being light.

Aug. 5 there was a slight reaction on the Exchange, followed by an increasing firmness. The Curb was broader and more active. Copper stocks were firm and there were good sales of other mining stocks. Standard Oil securities were in special request.

Aug. 6 and 7 business on the Exchange was on a moderate scale, with few changes and general firmness. The Curb was rather dull and interest in mining stocks was narrow, sales being few and price changes unimportant.

Sales of stock on the New York Exchange in July made up a total of 7,119,008 shares, which was 56,433 shares more than in June and 1,457,458 more than in July, 1911. Sales of bonds amounted to $51,198,000, being $5.684.000 more than in June, but $12,246,500 less than in July of last year.

*Boston, Aug. 6*—Mining shares do not do much either one way or the other. The market for these issues is at a low ebb, yet at the same time there is an undeniable strong tone. Butte & Superior has proven an exception to this, for not only has it been the most active stock on the list, but its fluctuations have been violent during the week. After breaking almost $6 to $38.25 it is back to $45.25. The development of this property into a zinc mine has created quite a furore for adjacent properties and the company itself, or its representatives, have options on several of them.

Lake Copper stock broke $4.25 to $33.75 but it has recovered all but $1 of the decline. This was largely a case of short selling and enforced covering.

The Calumet & Hecla management in the issuance of half-yearly reports of its subsidiary companies deserves warm words of praise. For the first half of this year Superior has earned $1.27 per share,

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

| Company | May | June | July |
|---|---|---|---|
| Alaska shipments. | 1,720,391 | 4,134,569 | ..... |
| Anaconda . . . . . | 25,800,000 | ..... | ..... |
| Arizona, Ltd. . . . . | 3,500,000 | 3,300,000 | ..... |
| Copper Queen. . . . . | 7,024,087 | 7,622,730 | 7,708,147 |
| Calumet & Ariz. . . . | 4,424,000 | 4,160,000 | 4,748,000 |
| Chino. . . . . | 1,275,850 | 1,474,979 | ..... |
| Detroit. . . . . | 2,092,478 | 1,959,634 | 2,194,090 |
| East Butte. . . . . | 1,445,000 | ..... | ..... |
| Mammoth. . . . . | 1,760,000 | ..... | ..... |
| Mason Valley. . . . . | 1,520,000 | ..... | ..... |
| Nevada Con. . . . . | 6,063,462 | 5,913,832 | ..... |
| Ohio. . . . . | 685,000 | ..... | ..... |
| Old Dominion. . . . . | 2,180,000 | 2,130,000 | ..... |
| Ray . . . . . | 2,924,913 | 2,992,500 | ..... |
| Shannon. . . . . | 1,464,000 | 1,270,000 | 1,446,000 |
| South Utah. . . . . | 236,884 | ..... | ..... |
| United Verde* . . . . . | 2,500,000 | ..... | ..... |
| Utah Copper Co. . . . | 9,564,919 | 8,772,742 | ..... |
| Lake Superior* . . . . | 21,250,000 | 15,600,000 | ..... |
| Non-rep. mines* . . . | 8,400,000 | 8,300,000 | ..... |
| Total production. | 105,830,984 | ..... | ..... |
| Imports, bars, etc. . | 25,836,519 | 24,262,292 | ..... |
| Total blister. . . . . | 131,697,503 | ..... | ..... |
| Imp. in ore & matte | 6,410,226 | 8,404,936 | ..... |
| Total American. . | 138,107,729 | ..... | ..... |
| Miami† . . . . . | 2,676,702 | 2,683,310 | 3,027,710 |
| Brit. Col. Cos.: | | | |
| British Col. Copper | 875,000 | 996,000 | ..... |
| Granby . . . . . | 1,914,460 | 1,888,400 | ..... |
| Mexican Cos.: | | | |
| Boleo† . . . . . | 2,260,160 | 1,851 920 | ..... |
| Cananea . . . . . | 4,600,000 | 4,310,000 | 4,000,000 |
| Moctezuma . . . . . | 2,892,521 | 3,176,819 | 3,094,016 |
| Other Foreign: | | | |
| Cape Cop., S. Africa | 754,880 | ..... | ..... |
| Kyshtim, Russia. . . | ..... | ..... | ..... |
| Spassky, Russia. . . | 694,400 | 757,120 | ..... |
| Famatina, Argen. . . | ..... | ..... | ..... |
| Tilt Cove, Newf'd. . | 123,087 | ..... | ..... |
| Exports from: | | | |
| Chile. . . . . | 3,696,000 | 9,856,000 | ..... |
| Australia . . . . . | 7,840,000 | 8,176,000 | ..... |
| Arrivals in Europe‡ | 9,976,860 | 12,667,200 | ..... |

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

| Month | U.S. Refin'y Product'n | Deliveries, Domestic | Deliveries for Export |
|---|---|---|---|
| VII, 1911. . . . . | 112,167,934 | 56,982,582 | 74,880,638 |
| VIII. . . . . | 125,493,667 | 59,935,364 | 69,855,660 |
| IX. . . . . | 115,588,950 | 57,311,584 | 50,824,011 |
| X. . . . . | 118,255,442 | 64,068,307 | 60,084,349 |
| XI. . . . . | 111,876,601 | 68,039,776 | 67,049,279 |
| XII. . . . . | 122,896,697 | 65,988,474 | 79,238,716 |
| Year . . . . . | 1,431,938,338 | 709,611,605 | 754,902,233 |
| I, 1912. . . . . | 119,337,753 | 62,343,901 | 80,167,904 |
| II. . . . . | 116,035,809 | 56,228,368 | 63,148,096 |
| III. . . . . | 125,694,601 | 67,487,466 | 58,779,566 |
| IV . . . . . | 125,464,644 | 69,513,846 | 53,252,326 |
| V. . . . . | 126,737,836 | 72,702,277 | 69,485,945 |
| VI . . . . . | 122,315,240 | 66,146,229 | 61,449,650 |
| VII. . . . . | ..... | ..... | ..... |

| | VISIBLE STOCKS | | |
|---|---|---|---|
| | United States | Europe | Total |
| VIII, 1911. . . . . | 137,738,858 | 191,891,840 | 329,630,698 |
| IX. . . . . | 133,441,501 | 191,228,800 | 324,670,301 |
| X. . . . . | 140,894,856 | 191,945,600 | 332,840,456 |
| XI. . . . . | 134,997,642 | 176,825,600 | 311,823,242 |
| XII. . . . . | 112,785,188 | 164,281,600 | 276,066,788 |
| I, 1912. . . . . | 89.454,695 | 158,323,200 | 247,777,895 |
| II. . . . . | 66,280,643 | 154,851,200 | 221,131,843 |
| III . . . . . | 62,939,988 | 141,142,400 | 204,082,380 |
| IV . . . . . | 62,367,557 | 136,819,200 | 199,186,754 |
| V. . . . . | 65,066,029 | 134,176,000 | 199,242,689 |
| VI. . . . . | 49,615,643 | 117,801,600 | 107,417,232 |
| VII. . . . . | 44,335,004 | 108,186,000 | 152,521,047 |
| VIII. . . . . | ..... | 113.299,200 | ..... |

the Centennial 30.8c. and the Allouez 61c. per share.

Curb trading has been quiet while price movements have been unimportant. Butte Central is strong around $7.50 while Nevada-Douglas is off 50c per share.

### Assessments

| Company | Delinq | Sale | Amt |
|---|---|---|---|
| Belcher, Nev | Aug. 15 | Aug. 30 | $0.10 |
| Belmont, Ida | July 22 | Aug. 22 | 0.002 |
| Confidence, Nev | July 15 | Aug. 9 | 0.20½ |
| Con. Imperial, Nev | July 28 | Aug. 21 | 0.01 |
| Con. Virginia, Nev | Aug. 11 | Sept. 5 | 0.20 |
| Conqueror, Ida | July 20 | Aug. 10 | 0.001½ |
| Dalmatia, Ida | Aug. 24 | Sept. 21 | 0.002 |
| Dennemora, Ida | July 20 | Aug. 20 | 0.002 |
| Eagle Mt., Ida | July 31 | Aug. 22 | 0.00½ |
| Gould & Curry, Nev | July 19 | Aug. 12 | 0.05 |
| Horseshoe Ida | Aug. 8 | Aug. 30 | 0.002 |
| Hypotheek, Ida | July 19 | Aug. 14 | 0.005 |
| Laclede, Ida | Aug. 1 | Aug. 24 | 0.003 |
| Lone Star, Nev | July 20 | ..... | 0.02 |
| Manhattan Red Top, Nev | July 12 | ..... | 0.01½ |
| Mineral Farm, Ida | July 15 | Aug. 15 | 0.002 |
| Mineral Hill, Nev | Aug. 5 | Oct. 5 | 0.01 |
| National Copper, Ida | July 15 | Aug. 15 | 0.01 |
| New Reliance, S. Dak | ..... | ..... | 0.01 |
| O. K. Silver Mining, Utah | July 15 | Aug. 1 | 0.002½ |
| Oreano, Ida | July 18 | Aug. 19 | 0.001 |
| Sandstorm-Kendall, Nev | July 8 | ..... | 0.01 |
| Seven Troughs Mon'h, Utah | Aug. 10 | Aug. 30 | 0.01 |
| Silver Mt., Ida | July 15 | Aug. 15 | 0.002 |
| Springfield, Ida | July 30 | Aug. 31 | 0.002 |
| Tonopah North Star, Nev | July 15 | ..... | 0.02 |
| Twin Star, Ida | Aug. 31 | Sept. 28 | 0.02 |
| Yellow Jacket, Nev | July 4 | Aug. 12 | 0.10 |

### Monthly Average Prices of Metals

SILVER

| Month | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1910 | 1911 | 1912 | 1910 | 1911 | 1912 |
| January | 52.375 | 53.795 | 56.260 | 24.154 | 24.865 | 25.887 |
| February | 51.534 | 52.222 | 59.043 | 23.794 | 24.081 | 27.190 |
| March | 51.454 | 52.745 | 58.375 | 23.690 | 24.324 | 26.875 |
| April | 53.221 | 53.325 | 59.207 | 24.483 | 24.595 | 27.284 |
| May | 53.870 | 53.308 | 60.880 | 24.797 | 24.583 | 28.038 |
| June | 53.462 | 53.043 | 61.290 | 24.651 | 24.486 | 28.215 |
| July | 54.150 | 52.630 | 60.654 | 25.034 | 24.286 | 27.919 |
| August | 52.912 | 52.171 | ..... | 24.428 | 24.082 | ..... |
| September | 53.295 | 52.440 | ..... | 24.567 | 24.209 | ..... |
| October | 55.490 | 53.340 | ..... | 25.596 | 24.594 | ..... |
| November | 55.635 | 55.719 | ..... | 25.680 | 25.649 | ..... |
| December | 54.428 | 54.905 | ..... | 25.160 | 25.349 | ..... |
| Year | 53.486 | 53.304 | ..... | 24.670 | 24.592 | ..... |

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

| | New York | | | | London, Standard | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Lake | | | |
| | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 |
| January | 12.295 | 14.094 | 12.680 | 14.337 | 55.600 | 62.760 |
| February | 12.256 | 14.084 | 12.611 | 14.329 | 54.974 | 62.893 |
| March | 12.139 | 14.698 | 12.447 | 14.868 | 54.704 | 65.884 |
| April | 12.019 | 15.741 | 12.275 | 15.930 | 54.034 | 70.294 |
| May | 11.989 | 16.031 | 12.214 | 16.245 | 54.313 | 72.352 |
| June | 12.385 | 17.234 | 12.611 | 17.443 | 56.365 | 78.259 |
| July | 12.463 | 17.190 | 12.720 | 17.353 | 56.673 | 76.636 |
| August | 12.405 | ..... | 12.634 | ..... | 56.266 | ..... |
| September | 12.201 | ..... | 12.508 | ..... | 55.253 | ..... |
| October | 12.189 | ..... | 12.370 | ..... | 55.170 | ..... |
| November | 12.616 | ..... | 12.769 | ..... | 57.253 | ..... |
| December | 13.552 | ..... | 13.768 | ..... | 62.068 | ..... |
| Year | 12.376 | ..... | 12.634 | ..... | 55.973 | ..... |

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

| Month | 1911 | 1912 | Month | 1911 | 1912 |
|---|---|---|---|---|---|
| January | 41.255 | 42.529 | July | 42.400 | 44.519 |
| February | 41.614 | 42.962 | August | 43.319 | ..... |
| March | 40.157 | 42.577 | September | 39.755 | ..... |
| April | 42.185 | 43.923 | October | 41.185 | ..... |
| May | 43.115 | 46.053 | November | 43.125 | ..... |
| June | 44.606 | 45.815 | December | 44.655 | ..... |
| | | | Av. Year | 42.281 | ..... |

Prices are in cents per pound.

LEAD

| Month | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 |
| January | 4.483 | 4.435 | 4.334 | 4.327 | 13.009 | 15.619 |
| February | 4.440 | 4.026 | 4.266 | 3.946 | 13.043 | 15.738 |
| March | 4.394 | 4.073 | 4.238 | 4.046 | 13.122 | 15.997 |
| April | 4.412 | 4.200 | 4.262 | 4.118 | 12.889 | 16.331 |
| May | 4.373 | 4.194 | 4.223 | 4.072 | 12.984 | 16.509 |
| June | 4.435 | 4.392 | 4.292 | 4.321 | 13.260 | 17.588 |
| July | 4.499 | 4.720 | 4.397 | 4.603 | 13.530 | 18.544 |
| August | 4.500 | ..... | 4.406 | ..... | 14.260 | ..... |
| September | 4.485 | ..... | 4.356 | ..... | 14.744 | ..... |
| October | 4.265 | ..... | 4.139 | ..... | 15.332 | ..... |
| November | 4.298 | ..... | 4.181 | ..... | 15.821 | ..... |
| December | 4.450 | ..... | 4.332 | ..... | 15.648 | ..... |
| Year | 4.420 | ..... | 4.286 | ..... | 13.970 | ..... |

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

| Month | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 |
| January | 5.452 | 6.442 | 5.302 | 6.292 | 23.887 | 26.642 |
| February | 5.518 | 6.499 | 5.368 | 6.349 | 23.276 | 26.661 |
| March | 5.563 | 6.626 | 5.413 | 6.476 | 23.016 | 26.048 |
| April | 5.399 | 6.633 | 5.249 | 6.483 | 23.743 | 25.644 |
| May | 5.348 | 6.679 | 5.198 | 6.529 | 24.375 | 25.790 |
| June | 5.520 | 6.877 | 5.370 | 6.727 | 24.612 | 25.763 |
| July | 5.695 | 7.116 | 5.545 | 6.966 | 25.006 | 26.174 |
| August | 5.953 | ..... | 5.803 | ..... | 26.801 | ..... |
| September | 5.869 | ..... | 5.719 | ..... | 27.750 | ..... |
| October | 6.102 | ..... | 5.951 | ..... | 27.256 | ..... |
| November | 6.380 | ..... | 6.223 | ..... | 26.795 | ..... |
| December | 6.301 | ..... | 6.151 | ..... | 26.849 | ..... |
| Year | 5.758 | ..... | 5.608 | ..... | 25.281 | ..... |

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

| | Bessemer | | Basic | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 |
| January | $15.90 | $15.12 | $14.40 | $13.32 | $14.75 | $14.00 |
| February | 15.90 | 15.03 | 14.50 | 13.28 | 14.81 | 14.01 |
| March | 15.90 | 14.95 | 14.65 | 13.66 | 14.96 | 14.10 |
| April | 15.90 | 15.13 | 14.65 | 13.90 | 15.00 | 14.15 |
| May | 15.90 | 15.14 | 14.30 | 13.90 | 14.72 | 14.12 |
| June | 15.90 | 15.15 | 14.06 | 14.11 | 14.56 | 14.22 |
| July | 15.90 | 15.15 | 14.03 | 14.38 | 14.53 | 14.38 |
| August | 15.90 | ..... | 14.00 | ..... | 14.47 | ..... |
| September | 15.90 | ..... | 13.57 | ..... | 14.40 | ..... |
| October | 15.43 | ..... | 13.44 | ..... | 14.34 | ..... |
| November | 14.92 | ..... | 13.30 | ..... | 14.25 | ..... |
| December | 15.15 | ..... | 13.10 | ..... | 13.90 | ..... |
| Year | $15.72 | ..... | $13.94 | ..... | $14.49 | ..... |

## STOCK QUOTATIONS

COLO. SPRINGS Aug. 6

| Name of Comp. | Bid. |
|---|---|
| Acacia | .05 |
| Cripple Cr'k Con. | .01½ |
| C. K. & N. | .17 |
| Doctor Jack Pot | .06 |
| Elkton Con. | .67½ |
| El Paso | 1.12½ |
| Findlay | .05½ |
| Gold Dollar | .18½ |
| Gold Sovereign | .03 |
| Isabella | .15 |
| Jack Pot | .04 |
| Jennie Sample | .05 |
| Lexington | .008 |
| Moon Anchor | ‡ 0085 |
| Old Gold | .03½ |
| Mary McKinney | .71 |
| Pharmacist | ‡.01½ |
| Portland | .92 |
| Vindicator | .85 |
| Work | .01½ |

SALT LAKE Aug. 6

| Name of Comp. | Bid. |
|---|---|
| Beck Tunnel | .07½ |
| Black Jack | .14 |
| Cedar Talisman | .01½ |
| Colorado Mining | .23½ |
| Columbus Con | ‡ .35 |
| Crown Point | .02½ |
| Daly-Judge | 5.60 |
| Grand Central | .62 |
| Iron Blossom | 1.22½ |
| Little Bell | ‡ 35 |
| Lower Mammoth | ‡ 03¼ |
| Mason Valley | 12.00 |
| May Day | .14 |
| Nevada Hills | 1.90 |
| New York | .01½ |
| Prince Con | 1.55 |
| Silver King Coal'n | 2.50 |
| Sioux Con | .04½ |
| Uncle Sam | .16 |
| Yankee | ‡.07 |

TORONTO Aug. 6

| Name of Comp. | Bid | Name of Comp. | Bid |
|---|---|---|---|
| Coniagas | 7 40 | Hollinger | 12.95 |
| Hudson Bay | 69.00 | Imperial | .02 |
| Temiskaming | .37 | Pearl Lake | .17 |
| Wettlaufer-Lor | .40 | Porcu. Gold | .28 |
| Apex | .02 | Porcu. Tisdale | .01 |
| Central | ‡5 56 | Preston E. D | .01 |
| Crown Chartered | .09 | Rea | .20 |
| Dobie | .40 | Standard | .00½ |
| Dome Exten | .15 | Swastika | .09 |
| Foley O'Brien | .14 | West Dome | .05 |

SAN FRANCISCO Aug. 6

| Name of Comp. | Clg. |
|---|---|
| COMSTOCK STOCKS | |
| Alta | .06 |
| Belcher | .36 |
| Best & Belcher | .08 |
| Caledonia | 1.25 |
| Challenge Con | .12 |
| Chollar | .10 |
| Confidence | .70 |
| Con. Virginia | .38 |
| Crown Point | .45 |
| Gould & Curry | .05 |
| Hale & Norcross | .12 |
| Mexican | 2.70 |
| Occidental | .50 |
| Ophir | .99 |
| Overman | .65 |
| Potosi | .04 |
| Savage | .10 |
| Sierra Nevada | .23 |
| Union Con | .66 |
| Yellow Jacket | .59 |

| Name of Comp. | Bid |
|---|---|
| MISC. NEV. & CAL. | |
| Belmont | 9.40 |
| Jim Butler | .65 |
| MacNamara | .22 |
| Midway | .57 |
| Mont.-Tonopah | 2.15 |
| North Star | .17 |
| West End Con | 1.70 |
| Atlanta | .27 |
| Booth | .08 |
| C.O.D. Con | .11 |
| Comb. Frac | .16 |
| Jumbo Extension | .40 |
| Pitts.-Silver Peak | .98 |
| Silver Pick | .12 |
| St. Ives | .30 |
| Tramp Con | ‡.02 |
| Argonaut | ‡2.00 |
| Bunker Hill | ‡4.50 |
| Cent. Eureka | .40 |
| So. Eureka | ‡2.90 |

N. Y. EXCH. Aug. 6

| Name of Comp. | Clg. |
|---|---|
| Amalgamated | 82¾ |
| Am. Agri. Chem | 59⅛ |
| Am.Sm.&Ref.,com | 83¾ |
| Am. Sm. & Ref., pf. | 108½ |
| Am. Sm. Sec., pf. B | 87¾ |
| Anaconda | 41⅝ |
| Batopilas Min | 1⅝ |
| BethlehemSteelpf | 70 |
| Chino | 34 |
| Comstock Tunnel | ‡.10½ |
| Federal M. & S., pf. | 43 |
| Goldfield Con | 3⅞ |
| GreatNor.,ore,,ctf. | 43½ |
| Guggen. Exp | ‡54½ |
| Homestake | 95 |
| Inspiration Con | 18¾ |
| Miami Copper | 30 |
| Nat'nalLead,com. | 59 |
| National Lead, pf. | 108½ |
| Nev. Consol | 21¾ |
| Pittsburg Coal, pf. | 91⅝ |
| Ray Con | 20⅞ |
| RepublicI&S,com. | 28 |
| Republic I & S, pf. | 87½ |
| SlossSheffi'd,com. | 55 |
| Sloss Sheffield, pf. | 100 |
| Tennessee Copper | 42¾ |
| Utah Copper | 62 |
| U. S. Steel, com | 71¾ |
| U. S. Steel, pf. | 112¼ |
| Va. Car. Chem. | 48 |

N. Y. CURB July 30

| Name of Comp. | Clg. |
|---|---|
| Barnes King | .40 |
| Beaver Con | .45 |
| Braden Copper | 6⅞ |
| B. C. Copper | 5⅛ |
| Buffalo Mines | 1.40 |
| Caledonia | .40 |
| Con. Ariz. Sm. | ⅝ |
| Davis-Daly | 2¾ |
| Diam'field-Daisy | 9 |
| Ely Con | .22 |
| Florence | .92 |
| Giroux | 5¼ |
| Gold Hill Con | ⅜ |
| Greene Cananea | 10½ |
| Greenwater | .06 |
| Internat. S. & R. | ‡124 |
| Kerr Lake | 2⅞ |
| Keystone | 2⅝ |
| La Rose | 3½ |
| McKinley-Dar-Sa. | 1⅜ |
| Min. Co. of A. new | 2⅞ |
| Motherlode Gold | 1 |
| Nev. Utah M. & S. | ‡ 02 |
| Nipissing Mines | 7⅞ |
| Ohio Copper | 1½ |
| Pacific Sm. & M | ¾ |
| South Live Oak | 2 |
| South Utah M. & S. | ⅝ |
| Standard Oil (Old) | 1040 |
| Stand'd Oil of N.J. | 419 |
| Stand'd Oil Subs. | 525 |
| Stewart | 1⅝ |
| Tonopah | 6⅞ |
| Tonopah Ex | 2½ |
| Tri-Bullion | ⅝ |
| Tularosa | 7⅛ |
| Union Mines | ⅛ |
| United Cop., pfd. | 10 |
| Yukon Gold | 3⅞ |

LONDON Aug. 7

| Name of Com | Clg. |
|---|---|
| Camp Bird | £1 7s 6d |
| Dolores | 1 10 0 |
| El Oro | 0 14 3 |
| Esperanza | 1 10 0 |
| Mexico Mines | 7 0 0 |
| Oroville | 0 5 3 |
| Stratton'sInd. | 0 3 1½ |
| Tomboy | 1 5 3 |

BOSTON EXCH. Aug. 6

| Name of Comp. | Clg. |
|---|---|
| Adventure | 8¼ |
| Ahmeek | ‡350 |
| Algomah | 6 |
| Allouez | 47 |
| Am. Zinc | 31¼ |
| Ariz. Com., ctfs. | 5⅝ |
| Bonanza | ‡.40 |
| Boston & Corbin | 7 |
| Butte & Balak | 3¼ |
| Calumet & Ariz | 75⅛ |
| Calumet & Hecla | 529 |
| Centennial | 22½ |
| Con. Mercur | .03 |
| Copper Range | 57⅛ |
| Daly West | 5½ |
| East Butte | 13⅞ |
| Franklin | 11¾ |
| Granby | 54 |
| Hancock | 29 |
| Hedley Gold | 17 |
| Helvetia | 1½ |
| Indiana | 18¾ |
| Island Cr'k, com | 56 |
| Island Cr'k, pfd. | 91 |
| Isle Royale | 35 |
| Keweenaw | 1½ |
| Lake | 36½ |
| La Salle | 6¾ |
| Mass | 6¾ |
| Michigan | 2½ |
| Mohawk | 68 |
| New Arcadian | 4 |
| New Idria Quick | ‡07⅛ |
| North Butte | 30 |
| North Lake | 6 |
| Ojibway | 4 |
| Old Dominion | 57¾ |
| Osceola | ‡116 |
| Quincy | 92 |
| Shannon | 17¼ |
| Shattuck-Ariz | 20 |
| Superior | 47½ |
| Superior & Bost. | 1½ |
| Tamarack | 44 |
| Trinity | 6⅛ |
| Tuolumne | 3⅛ |
| U. S. Smelting | 46½ |
| U. S. Smelt'g, pf. | 49⅜ |
| Utah Apex | 1⅜ |
| Utah Con | 12¼ |
| Victoria | 3 |
| Winona | 5½ |
| Wolverine | 107 |
| Wyandot | ‡2 |

BOSTON CURB Aug. 6

| Name of Comp. | Last |
|---|---|
| Bingham Mines | 3½ |
| Boston Ely | 1 |
| Boswycocolo | .02 |
| Butte Central | 7⅛ |
| Cactus | .08 |
| Calaveras | 2¾ |
| Chief Cons | 1¾ |
| Corbin | 1⅞ |
| Cortez | 1 |
| Crown Reserve | 3⅛ |
| First Nat. Cop. | 2⅛ |
| Majestic | .46 |
| Mazatan | ‡½ |
| Moneta Porc | .05 |
| Nevada-Douglas | 3½ |
| New Baltic | 2⅜ |
| Oneco | 1⅛ |
| Raven Copper | .29 |
| Rhode Island Coal | .21 |
| San Antonio | ‡3 |
| S. W. Miami | 5½ |
| South Lake | 9½ |
| Trethewey | .41 |
| United Verde Ext. | .40 |
| Vulture | ‡5 |

*Last quotation.